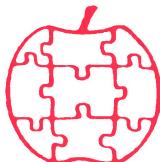


Apple



Assembly Line

\$1.80

Volume 7 -- Issue 8

May, 1987

A New Pattern Search Monitor Command	2
Reading the IIgs ROMs.	13
More About Patching Apple's ProDOS Releases.	14
ABC*DE=FG*HI Puzzle Solved	18
Problem with IIgs 3.5" Drive Firmware.	26
IIgs Tool Set Version Numbers.	29

The Chips are Falling

We have just learned that Western Design Center is dramatically lowering the price of the 65802 microprocessors. We've been selling the '802 for \$50.00: Effective about the time you read this our price will be \$25.00. All the chips they produce are now rated to operate to at least 4 MHz, and they're now getting a significant yield of 6 and even 8 MHz parts. Evidently the volume production made possible by Apple's use of the 65816 in the IIgs is paying off.

Missing ProDOS Books

We had a scare a couple of weeks ago: Quality Software and Simon & Schuster had both run out of copies of *Beneath Apple ProDOS*, that excellent reference on the inner workings of ProDOS, so it looked for a while like we might lose a valuable resource. All is well, though, the folks at Quality are planning a new printing, so we expect to have more copies of the book in a month or two. We'll just hold any orders until that time.

Curiously, both Addison-Wesley's *ProDOS Technical Reference Manual* and Simon & Schuster's *Apple ProDOS: Advanced Features for Programmers* have been out of stock at the publishers for a couple of months now. A-W tells us that a revised edition of Apple's manual will be published in late June. S & S has *Advanced Features* on backorder, but won't quote even a tentative delivery date.

A New Pattern Search Monitor Command.....Bob Sander-Cederlof

As I mentioned in my description of the new Apple IIgs monitor commands (AAL Jan 87, pp.23-27), there is a new "P" command which searches through a range of memory for all occurrences of a pattern. Well, I tried to use that command the other day.

First, I couldn't remember with confidence what the syntax was. Then I thought that it must be \pattern\adrl.adr2P. I tried that and it did not work. I looked it up in Fischer's "IIgs Technical Reference", and verified that I did have the correct syntax. It still did not work, and I did need a search capability, so I wrote my own. More on it later. That was last week. I don't know why I didn't look up the command in another reference, but today I did. Both my memory and Fischer's book were wrong!

For some esoteric reason, Apple requires that the "<" character appear between the pattern and the address range. My January article and Apple's own reference material clearly show the "<" there: \pattern\<adrl.adr2P is the correct syntax. Type it correctly, and it works as advertised. For example:

```
\8E C0\<0/2000.5FFFF will search $2000 through $5FFF  
in bank 0 for the two bytes $8E  
and $C0 in successive locations.  
\"Apple"\<FF/0.FFFFF will search all of bank $FF  
for the string "Apple". (In my  
IIgs it found that string five  
times.)
```

If you leave out the "<" character, nothing happens.

The "P" command is a powerful tool, and a welcome addition the Apple monitor. However, I still need some capabilities it does not have. For example, what if I want to find all references to a particular address made using any of the LDA instructions. I don't want to see any references using LDX, LDY, CMP, STA, etc. If I could tell it to only compare certain bits in some bytes, I could accomplish this and many other interesting feats. We might also like the feature of allowing a variable length wild card, such as in FID and FILER filenames and in the S-C Macro Assembler REPLACE command. Maybe I want to include the ability to find PC-relative references to an address. There is probably an endless list of possible features.

I did write a new search program, and did include one of the above mentioned new features. I linked it in through the control-Y vector, so that I can use it from within the monitor. It in effect adds a new command to the monitor, with this syntax "adrl.adr2Ypattern". (Where I show "Y", you have to type control-Y. If you are using the command from within the S-C Macro Assembler, you have to type control-O followed by control-Y.) The pattern is a sequence of hex bytes and/or byte-pairs. A hex byte will have to be completely matched. A byte-pair specifies which bits to compare by giving both a mask byte and a key byte. For example:

S-C Macro Assembler Version 2.0.....DOS \$100, ProDOS \$100, both for \$120
 Version 2.0 DOS Upgrade Kit for 1.0/1.1/1.2 owners.....\$20
 ProDOS Upgrade Kit for Version 2.0 DOS owners.....\$30
 Source Code of S-C Macro 2.0 (DOS or ProDOS).....each, additional \$100
 S-C DisAssembler (ProDOS only).....without source code \$30, with source \$50
 RAK-Ware DISASM (DOS only).....without source code \$30, with source \$50
 ProVIEW (ProDOS only).....\$20
 Full Screen Editor for S-C Macro (with complete source code).....\$49
 S-C Cross Reference Utility.....without source code \$20, with source \$50
 S-C Word Processor (with complete source code).....\$50
 DP18 and DPFP, including complete source and object code.....\$50
 ES-CAPE (Extended S-C Applesoft Program Editor).....
 Including Version 2.0 With Source Code.....\$50
 ES-CAPE Version 2.0 and Source Code Update (for Registered Owners)....\$30
 Bag of Tricks 2 (Quality Software).....(\$49.95) \$45 *
 MacASM -- Macro Assembler for MacIntosh (Mainstay).....(\$150.00) \$50 *
 S-C Documentor (complete commented source code of Applesoft ROMs)....\$50
 Cross Assemblers for owners of S-C Macro Assembler....\$32.50 to \$50 each
 (Available: 6800/1/2, 6301, 6805, 6809, 68000, Z-80, Z-8, 8048,
 8051, 8085, 1802/4/5, PDP-11, GII650/70, others)
 Beagle Bros. Applesoft Compiler (ProDOS only).....(\$74.95) \$65 *

 AAL Quarterly Disks.....each \$15, or any four for \$45
 Each disk contains the source code from three issues of AAL:
 Jan-Mar, Apr-Jun, Jul-Sep, and Oct-Dec.
 (All source code is formatted for S-C Macro Assembler. Other assemblers
 require some effort to convert file type and edit directives.)

 Diskettes (with hub rings)..... package of 25 for \$15 *
 Vinyl disk pages, 6"x8.5", hold two disks each.....10 for \$6 *
 Diskette Mailing Protectors (hold 1 or 2 disks).....40 cents each
 (Cardboard folders designed to fit 6"X9" Envelopes.) or \$25 per 100 *
 Envelopes for Diskette Mailers.....6 cents each

 65802 Microprocessor (Western Design Center).....(\$95) \$95 *
 quikLoader EPROM System (SCRG).....(\$179) \$170 *
 PROmGRAMER (SCRG).....(\$149.50) \$140 *
 Minuteman 250 Uninterruptible Power Supply.....(\$359) \$320 +

 "Apple //gs Technical Reference", Fischer.....(\$19.95) \$19 *
 "65816/65802 Assembly Language Programming", Fischer.....(\$21.95) \$20 *
 "Programming the 65816", Eyes.....(\$22.95) \$21 *
 "Apple //e Reference Manual", Apple Computer.....(\$24.95) \$23 *
 "Apple //c Reference Manual", Apple Computer.....(\$24.95) \$23 *
 "ProDOS Technical Reference Manual", Apple Computer.....(\$29.95) \$27 *
 "Apple ProDOS: Advanced Features for Programmers", Little..(\$17.95) \$17 *
 "ProDOS Inside and Out", Doms & Weishaar.....(\$16.95) \$16 *
 "DOStalk Scrapbook", Weishaar & Kersey.....(\$14.95) \$14 *
 "Beneath Apple ProDOS", Worth & Lechner.....(\$19.95) \$18 *
 "Beneath Apple DOS", Worth & Lechner.....(\$19.95) \$18 *
 "Inside the Apple //c", Little.....(\$19.95) \$18 *
 "Inside the Apple //e", Little.....(\$19.95) \$18 *
 "Understanding the Apple //e", Sather.....(\$24.95) \$23 *
 "Understanding the Apple II", Sather.....(\$22.95) \$21 *
 "Apple II+/IIe Troubleshooting & Repair Guide", Brenner.....(\$19.95) \$18 *
 "Apple][Circuit Description", Gayler.....(\$22.95) \$21 *
 "Assem. Language for Applesoft Programmers", Finley & Myers.(\$18.95) \$18 *
 "Now That You Know Apple Assembly Language...", Gilder.....(\$19.95) \$18 *
 "Enhancing Your Apple II, vol. 1", Lancaster.....(\$15.95) \$15 *
 "Enhancing Your Apple II, vol. 2", Lancaster.....(\$17.95) \$17 *
 "Assembly Cookbook for the Apple II/IIe", Lancaster.....(\$21.95) \$20 *
 "Microcomputer Graphics", Myers.....(\$14.95) \$14 *
 "Assembly Lines -- the Book", Wagner.....(\$19.95) \$18 *
 "AppleVisions", Bishop & Grossberger.....(\$39.95) \$36 *

* On these items add \$2.00 for the first item and
 \$.75 for each additional item for US shipping.

+ Inquire for shipping cost.

Foreign customers inquire for postage needed.

Texas residents please add 7.25 % sales tax to all orders.

*** S-C SOFTWARE, P. O. BOX 280300, Dallas, TX 75228 ***

*** (214) 324-2050 ***

*** Master Card, VISA, Discover and American Express ***

0/2000.5FFFFYAD F0:80 C0 will find all occurrences
of LDA \$C080 through \$C08F in
bank 0, 2000-5FFF.

FF/0.5FFFFYCl DF:D0 DF:CC DF:C5 will find all
occurrences of "Apple" without
regard to upper or lower case.

In the January issue of AAL I also discussed the way to hook into the control-Y vector in the IIgs. It is different from the older Apples. Lines 1160-1230 in the following program install the control-Y vector in a IIgs. In an older Apple we would store only a 2-byte address at \$3F9 and \$3FA. This will still work in a IIgs, but then you would be limited to running in bank 0 in emulation mode. The bank \$E1 vector allows you to be called in native mode, and your code can be in any bank of memory.

When you enter a control-Y command (assuming the vector has been installed) control will come to the SEARCH program. Lines 1260-1290 are a nice general way to save the current mode and status and get into emulation mode. Lines 1600-1630 restore the mode and status before returning.

Lines 1310-1320 call the GET.PATTERN subroutine and quit if that subroutine reports an error. GET.PATTERN scans the input buffer from just after the control-Y to a carriage return. It seemed reasonable to me to require that the entire command line be in the first 127 characters of the input buffer; that left the other half (\$280-2FF) free for me to use for storing the converted key and mask bytes. GET.PATTERN stores the key bytes starting at \$280, and the mask bytes starting at \$2C0. It returns the number of bytes in the key in the X-register. Line 1330 stores this count at WBUF, which happens to also be the beginning of the input buffer.

Lines 1340-1350 copy the bank byte of the address range from the place the monitor keeps it (\$E1013E) to the end of a 3-byte pointer in page zero. This seems like a good time to list all the places the monitor puts the addresses it parses. The general form of a monitor command is "a/b<c/d.eX". "a/b" is a target address, with "a" specifying the bank and "b" specifying the address within the bank. "c/d" is the beginning address of a range, with "c" specifying the bank and "d" the address within the bank. "e" is the ending address of the range, in the same bank with "d". "X" represents any monitor command letter. Some commands do not use all of the parsable parts, but you can usually get away with entering them anyway. The monitor subroutine called GETNUM is responsible for parsing the addresses. In older machines GETNUM was at \$FFA7. In the IIgs there is still a copy of GETNUM at \$FFA7, but it is not used. Instead a new version which starts at \$F888 is used. This new version allows the "a/" and "c/" parts. From my analysis, here is where the new GETNUM stores a, b, c, d, and e:

a -- \$E1/013F
b -- \$00/0042,43
c -- \$E1/013E

d -- \$00/003C,3D and \$00/0040,41
e -- \$00/003E,3F

GETNUM will also leave the pointer into the input buffer which points to the next character after the command character in YSAVE, which is \$00/0034.

The IIgs also has a new subroutine at \$FCCA, which gets the next character from the input buffer and converts it from lower-case to upper-case if it is a lower-case letter.

Lines 1370-1580 perform the actual search operation. Lines 1370-1440 compare the masked portions of the key bytes with the masked portion of the memory bytes starting at PNTR. If they all match, lines 1460-1490 call on PRADR to print the 3-byte address. Lines 1500-1580 increment the PNTR and test to see if we have come to the end of the range. [Note that a multiple-byte key will be tested beyond the end of the range. That is, the search will continue until the first key byte has been tested throughout the range. This means the key bytes after the first one will extend beyond the end of the range. I am pointing this out so that you will not accidentally start tripping softswitches in the I/O space when you have a range ending at \$BFFF.]

There are ample possibilities here for you to expand the features of this search. You could add to the GET.PATTERN a more flexible wild-card scheme. You could allow ASCII strings to be entered. You could automatically protect the I/O softswitch range, especially \$C000-COFF. You could save the current shadowing status and then turn off all shadowing during the search. And so on.

I slipped in another little routine at lines 2150-2420. I am not calling it here, but when I did it printed out the currently parsed addresses. It helped me to get a better feeling for what happens when you enter an incomplete address specification. If you leave off the bank, it uses the same one you used before. If you leave out the range beginning, it begins where the previous command ended. There are a lot of choices here, so I find I usually just type the complete command to be sure.

34-	1000 *SAVE S.SEARCH.IIGS
3E-	1010 -----
40-	1020 YSAVE .EQ \$34
	1030 END .EQ \$3E,3F ADDRESS OF END OF RANGE
	1040 PTRN .EQ \$40,41,42 START OF RANGE, CURRENT PNTR
	1050 -----
0200-	1060 WBUF .EQ \$200
0280-	1070 KBUF .EQ \$280
02C0-	1080 MBUF .EQ \$2C0
	1090 -----
FCCA-	1100 NXTCCHR .EQ \$FCCA
FD8E-	1110 CROUT .EQ \$FD8E
FDDA-	1120 PRBYTE .EQ \$FDAA
FDDED-	1130 COUT .EQ \$FDDE
	1140 -----

17 Meg Ile/1 Meg IIC

Want the best & easiest-to-use (most support) RAM card on the market — at the best price? Buy Checkmate Technology's State-Of-The-Art MULTIRAM RGB RAM CARD™ from us w/BATTERY BACKED-UP RAM options that save programs like AppleWorks for years! **FAST CHEAP REPLACEMENT FOR HARD DISKS, USER EXPANDABLE TO 17 MEGS.**, (100%) compatible w/all 3rd party software/hardware, 65C816 option (\$147), sharp 80 columns/Double Hi-Res, & FREE RGB! Direct substitute for Ramworks I-I™ (we think it's better) by Applied Engineering (also known as Preferred Computing) or Apple 80 col cards, has a **5 YR WARRANTY**, 15 day money back guarantee, & **FREE AUTOMATIC SOFTWARE UPDATES ONLY FROM US!**

MultiRam RGB expands to 1 Meg + optional BATTERY PROTECTABLE MultiRam Plus piggyback expandable to 16 Meg's. MultiRam Ile expands to 768k. The software & manual is the best & easiest-to-use on the market — without exception!

FREE APPLEWORKS EXPANDER SOFTWARE W/EVERY CARD—loads ALL versions of Appleworks (in 30 seconds w/AW 2.0), even printer routines, runs faster, Desktop 2048k, 23,000+ records & 4,800+ word proc lines, segments Ig files onto multiple disks! **FREE AWTIME/DAY/DATE ON-SCREEN** w/ clock, AUTO-COPY TO RAM, PRODOS/DOS 3.3. RAM DISK & TEST. Optional CP/M & Pascal Ram disks (\$20/ea)!)

	MultiRam	MultiRam
	RGB Card	Ile Card
64k MultiRam	159.	129.
320k MultiRam	189.	157.
576k MultiRam	219.	187.
832k MultiRam	244.	212.
1024k MultiRam	269. ← ← ←	
 MultiRam Plus Piggyback		
256k MultiRam Plus	219.	NEW
512k MultiRam Plus	269.	NEW
768k MultiRam Plus	316.	NEW
1024k MultiRam Plus	359.	NEW
2-17 meg MultiRam Plus	Call	NEW
Battery/AC Kit (for Plus)	36.	NEW

WHY BUY FROM COIT VALLEY COMPUTERS RATHER THAN SOME MAIL ORDER HOUSES? Only we offer a 15 day MultiRam complete **money back satisfaction guarantee**, extra software, more support, **free automatic software updates**, free 64k w/ each 256k/512k/768k Ile/RGB card. We know the products, & stock them for fast shipping! CALL FOR SUPPORT, QUESTIONS, PRICES, DISCOUNTS. **SCHOOLS & GROUPS WELCOME.**

Checkmate Technology's MultiRam CX card easily expands your Ile to 640k and has a CX + Piggyback to add another 512k (1152k total)! It's 100% compatible with all Ile software/hardware & upgradable with a 65C816 kit (\$95) — all at about 50% less power than Z-RAM™! Has the **SAME FREE SOFTWARE/UPDATES & 5 YR WARRANTY AS Ile CARDS**. Buy a C-VUE flat panel display for \$287 w/ 512k or greater card.

256k MULTIRAM CX	155.
512k MULTIRAM CX	184.
768k MULTIRAM CX Combo	328.
1024k MULTIRAM CX Combo	354.
256k MULTIRAM CX+	199.
512k MULTIRAM CX+	209.
1200 Baud Ile Modem (add \$20 for cable)	147.
Clip-on Ile Rechargeable Battery	115.
Ile Flat Panel Display (w/ 512k > Mram)	287.
Ile System Clock	69.

Cermeket 1200 internal modem Ile/Ile+/Ilg . 148.
(+ **FREE** Source subscription/ VT 100 Shareware/
ASCII Express & ProTERM™ Setup Instructions)

Slot 1-7 Ram Card for II+, Ile, Laser	Call
ProAPP 20 Meg Hard Disks (+ FREE software)	Call
Apple Ile Enhancement Kit	62.
Apple Ig	Call
Apple 3.5 800k Unidrive (Ile/Ile/Ilg)	319.
Super Serial Compatible Card	87.
RamPak 512k gs RAM card	196.
Apple Compatible Drive Ile/II+ (Ilg/Ile + \$19)	132.
Clockworks Clock (Thunder/TimeHO™ compat)	84.
13" RGB Monitor w/ cables (req. RGB card)	327.
Heavy Duty Power Supply II/II+/Ile	69.
Ile Programmable Numeric Keypad	85.
System Saver Fan (II/II+/Ile)	66.
Uninterruptable Power Supply 250 watt	299.
AutoWorks (Best AW Macro + more)	35.
FontWorks (Best AW sideways/Fonts & more)	35.
Pinpoint Program	55.
Pinpoint Document Checker (Best Speller)	45.
Copy II Plus 7.3 (Best ProDOS Utility)	29.
ProTERM Modem Software	84.
ASCII Express Modem Software	84.
VIP Professional (Lotus Clone, Specify Comp)	169.

Terms: Add \$4-Ground or \$6-Air shipping & phone # to each U.S. MultiRam card order (foreign orders/FPO/APO extra). Add 3% for MasterCard/Visa/Amer Exp (include expire date) & P.O.'s. For fast delivery send Cashier's/Certified check/Money Order. C.O.D. (add \$5) & personal checks accepted (allow 16 days). Tex res add 7 1/4% tax. Software non-returnable.

Ordering: PRINT Name & address, Res & Bus phone, credit card name/number/expir date where appropriate, qty/description/price/shipping charges if known. Call for questions.

Appleworks, Ramworks, II/Timewriter II, II/II+, Z-RAM, respectively trademarks of Software Touch, Applied Engineering, Inc., subject to change.

COIT VALLEY COMPUTERS
(214) 234-5047

MCI 2969584
Tele 6502969584 MCI UW

14055 Waterfall Way
Dallas, Texas 75240

	1150	.OP 8	
000800-	A9 13	1160 T	LDA #\$SEARCH Setup Control-Y vector
000802-	8F A1 00 E1	1170 STA \$E100A1	
000806-	A9 08	1180 LDA /\$SEARCH	
000808-	8F A2 00 E1	1190 STA \$E100A2	
00080C-	A9 00	1200 LDA #0	
00080E-	8F A3 00 E1	1210 STA \$E100A3	
000812-	60	1220 RTS	
		1230	*
		1240	*
000813-	08	1250 SEARCH	-----
000814-	38	1260 PHP Save mode, get into emulation mode	
000815-	FB	1270 SEC	
000816-	08	1280 XCE	
		1290 PHP	
		1300	*
000817-	20 54 08	1310 JSR GET.PATTERN Crack the search pattern	
00081A-	BO 34	1320 BCS .99 ...nothing there or too long	
00081C-	8E 00 02	1330 STX WBUF save # bytes in pattern	
00081F-	AF 3E 01 E1	1340 LDA \$E1013E Bank to search	
000823-	85 42	1350 STA PNTR+2 make 3-byte address	
		1360	-----
000825-	A0 FF	1370 .1 LDY #-1	
000827-	C8	1380 .2 INY	
000828-	B7 40	1390 LDA >(PNTR),Y Byte from source	
00082A-	59 80 02	1400 EOR KBUF,Y Byte from pattern	
00082D-	39 C0 02	1410 AND MBUF,Y Byte from mask	
000830-	D0 0E	1420 BNE .3 ...does not pass inspection	
000832-	CC 00 02	1430 CPY WBUF At end of pattern yet?	
000835-	90 F0	1440 BCC .2 ...no	
		1450	-----
000837-	A5 42	1460 LDA PNTR+2 Print 3-byte address	
000839-	A2 40	1470 LDX #PNTR	
00083B-	A0 A0	1480 LDY # " " ...followed by a blank	
00083D-	20 DF 08	1490 JSR PRADR	
		1500	-----
000840-	A5 40	1510 .3 LDA PNTR Set carry if at end of range	
000842-	C5 3E	1520 CMP END	
000844-	A5 41	1530 LDA PNTR+1	
000846-	E5 3F	1540 SBC END+1	
000848-	E6 40	1550 INC PNTR Bump comparison pointer	
00084A-	D0 02	1560 BNE .4	
00084C-	E6 41	1570 INC PNTR+1	
00084E-	90 D5	1580 .4 BCC .1	
		1590	*
000850-	28	1600 .99 PLP Restore machine mode	
000851-	FB	1610 XCE	
000852-	28	1620 PLP	
000853-	60	1630 RTS	
		1640	*
		1650 GET.PATTERN	-----
000854-	A4 34	1660 LDY YSAVE	
000856-	A2 FF	1670 LDX #-1	
000858-	E8	1680 .1 INX	
000859-	A9 FF	1690 LDA #\$FF Assume mask =\$FF	
00085B-	9D C0 02	1700 .2 STA MBUF,X Store a mask value	
00085E-	A9 00	1710 LDA #\$00 Start Keybyte = \$00	
000860-	9D 80 02	1720 .3 STA KBUF,X	
000863-	C0 7F	1730 CPY #\$7F	
000865-	BO 3D	1740 BCS .7 ...LINE TOO LONG	
000867-	20 CA FC	1750 JSR NXTCHR GET UPPER-CASE CHAR AT WBUF,Y	
00086A-	C9 A0	1760 CMP # " " Is it a space?	
00086C-	F0 EA	1770 BEQ .1 ...yes, next byte	
00086E-	C9 BA	1780 CMP # " :"	
000870-	90 11	1790 BCC .5 < \$BA, must be 0...9	
000872-	D0 05	1800 BNE .4 > \$BA, must be A...F	
000874-	BD 80 02	1810 LDA KBUF,X = \$BA, ":" means to put	
000877-	BO E2	1820 BCS .2 ...ALWAYS value into MASK	
		1830	-----
000879-	C9 C7	1840 .4 CMP # "G"	
00087B-	BO 27	1850 BCS .7 ...ERROR	
00087D-	C9 C1	1860 CMP # "A"	
00087F-	90 23	1870 BCC .7 ...ERROR	
000881-	E9 07	1880 SBC #7 "A"..."F"	
		1890	-----
000883-	C9 B0	1900 .5 CMP # "0"	Is it 0...9 or A...F?
000885-	90 14	1910 BCC .6 ...no	

000887-	29	0F	1920	AND #\$0F	..yes, isolate digit
000889-	1E	80	02	ASL KBUF,X	Shift previous value
00088C-	1E	80	02	ASL KBUF,X	
00088F-	1E	80	02	ASL KBUF,X	
000892-	1E	80	02	ASL KBUF,X	
000895-	1D	80	02	ORA KBUF,X	Merge with digit
000898-	4C	60	08	JMP .3	
			1980	*----End of line or error-----	
00089B-	C9	8D	2000	CMP #\$8D	
00089D-	D0	05	2010	BNE .7	...ERROR
00089F-	88		2020	DEY	
0008A0-	84	34	2030	STY YSAVE	
0008A2-	18		2040	CLC	
0008A3-	60		2050	RTS	
			2060	*----Bad char or line too long----	
0008A4-	84	34	2070	STY YSAVE	
0008A6-	A9	8D	2080	LDA #\$8D	STORE <RETURN> IN MONITOR
0008A8-	99	01	2090	STA WBUF+1,Y	INPUT BUFFER
0008AB-	A9	87	2100	LDA #\$87	RING THE BELL
0008AD-	20	ED	2110	JSR COUT	
0008B0-	38		2120	SEC	INFORM OF ERROR
0008B1-	60		2130	RTS	
			2140	*	
			2150	DISPLAY ADDRESSES	
0008B2-	08		2160	PHP	
0008B3-	38		2170	SEC	
0008B4-	FB		2180	XCE	
0008B5-	08		2190	PHP	
			2200	*	
0008B6-	A5	34	2210	LDA YSAVE	WBUF,Y POINTS TO NEXT CHAR
0008B8-	20	DA	2220	JSR PRBYTE	AFTER THE CTRL-Y
0008BB-	20	8E	2230	JSR CROUT	
			2240	*	
0008BE-	AF	3F	01	E1	2250 LDA \$E1013F
0008C2-	A2	42	2260	LDX #PNTR+2	
0008C4-	A0	BC	2270	LDY #<"	
0008C6-	20	DF	08	2280	JSR PRADR
			2290	*	
0008C9-	AF	3E	01	E1	2300 LDA \$E1013E
0008CD-	A2	40	2310	LDX #PNTR	
0008CF-	A0	AE	2320	LDY #". "	
0008D1-	20	DF	08	2330	JSR PRADR
			2340	*	
0008D4-	A2	3E	2350	LDX #END	
0008D6-	A0	8D	2360	LDY #\$8D	
0008D8-	20	E7	08	2370	JSR PRADRO
			2380	*	
0008DB-	28		2390	PLP	
0008DC-	FB		2400	XCE	
0008DD-	28		2410	PLP	
0008DE-	60		2420	RTS	
			2430	*	
0008DF-	20	DA	FD	2440	PRADR JSR PRBYTE PRINT BANK
0008E2-	A9	AF		2450	LDA #"/"
0008E4-	20	ED	FD	2460	JSR COUT
			2470	PRADRO	
0008E7-	B5	01		2480	LDA 1,X PRINT HI-BYTE OF ADDRESS
0008E9-	20	DA	FD	2490	JSR PRBYTE
0008EC-	B5	00		2500	LDA 0,X PRINT LO-BYTE OF ADDRESS
0008EE-	20	DA	FD	2510	JSR PRBYTE
0008F1-	98			2520	TYA PRINT TRAILING CHAR
0008F2-	4C	ED	FD	2530	JMP COUT
			2540	*	

Another project I thought of was modifying this search program so that it could run in an older Apple. Naturally we would lose the 3-byte addresses, so the program actually becomes simpler. A listing of this simpler version is shown below.

AE Update . . .

The fastest IIgs memory product on the market is now available with Applied Engineering's GS-RAM and GS-RAM Plus memory cards. AE's GS-RAM and GS-RAM Plus now include a new disk caching feature which can be used independently or with the Apple IIgs RAMdisk. (Although a RAMdisk is faster, disk caching is easier to use.) Caching significantly improves Apple Disk 3.5 access time. The new caching technique uses highly efficient and optimized machine language programs providing ultra fast, state-of-the-art dynamic disk caching in both ProDOS 8 and ProDOS 16 environments. This new enhancement makes GS-RAM and GS-RAM Plus the fastest IIgs memory cards on the market today. Ultra fast disk caching is now included with all GS-RAM and GS-RAM Plus purchases. Current GS-RAM users can obtain an upgrade for \$10.

Applied Engineering's DataLink modem is now ready to order with delivery in 2-3 weeks. DataLink is the newest and most advanced internal 1200/300 baud modem available today. DataLink incorporates the latest "modem on a chip" technology. Some of the components are so advanced they did not exist only one year ago. Because slot 2 is the normal location for a modem, Applied Engineering made an extra effort to make DataLink the only internal modem small enough to fit in slot 2 without interfering with the Apple IIgs's built-in fan. DataLink works in the Apple IIe and II+ as well. DataLink includes powerful communications software both in EPROM and on disk. This state-of-the-art modem has a retail price of only \$219 and is covered by a 5 year warranty.

New video digitizer is in the final stages of development. Unlike older techniques, Applied Engineering's video digitizer incorporates its own high speed memory which solves many of the problems that the current DMA dependent video digitizers inherently have. Whereas other video digitizers are IIgs only, this new process will allow the Applied Engineering card to also work in an Apple IIe and II+ as well as the IIgs. Video digitizers on the market at present require many video frames in order to digitize a picture. This results in a digitized image that shows tearing or distortion if there is motion when the image is digitized. Applied Engineering's design is capable of digitizing a complete color or black-and-white image in a single frame, thereby eliminating distortion. Because the design incorporates three separate "flash analog-to-digital converters" it can actually digitize to a greater resolution than the Apple is capable of displaying on screen. However, the high resolution image can be reproduced on most printers and the video image is displayed to the maximum resolution on the Apple's monitor. The product should be available in September. A price has not been set but is expected to be in the \$250 range.

Nonvolatile GS memory board soon to be released by Applied Engineering. The new card can piggyback to the GS-RAM and GS-RAM Plus cards or be used independently and uses standard dynamic RAM chips. It is available in 1 megabyte and 2 megabyte sizes. The memory on the board can be used as system memory or partitioned as a ROMdisk in 128K increments. If a RamCharger battery back up unit is connected, the memory is non-volatile. There are other techniques for creating non-volatile memory in the Apple IIgs memory expansion slot. One is the use of EPROMS. The engineers at Applied rejected this approach because of the difficulty in programming and reprogramming whenever customers wanted to update their software. The difficulty in programming and changing EPROMs combined with their relatively small memory capacities meant this approach was not acceptable. Another technique is to use SRAMs (Static RAMs) or EEPROMs (Electrically Erasable PROMs). These memory devices are easily programmed by the user but present the disadvantages of relatively small capacity and high cost. AE's solution uses 1 megabyte DRAMs with a battery backed-up refresh circuit. This allows the currently available RamCharger battery back-up unit to be plugged directly into the new expander to give permanent non-volatile storage. The card can also be used without the RamCharger as additional memory expansion. AE's solution has the advantages of large capacity and low cost.

Applied Engineering's new MS-DOS card (code named "Little Blue") is proceeding as planned. AE expects to be shipping product in October or November. Testing indicates that the product will be compatible with approximately 98% of IBM software; all major MS-DOS software is compatible. The card is expected to retail for approximately \$500.

Applied Engineering is seeking an experienced 6502 machine language programmer to develop software and firmware for its future line of Apple peripherals. Minimum 2 years Apple programming experience required. Send your resume to Applied Engineering, P.O. Box 798, Carrollton, TX 75006 Attn: Personnel.

AE APPLIED ENGINEERING™
The Apple enhancement experts

```

1000 *SAVE S.SEARCH.II
1010 *
34- 1020 YSAVE .EQ $34
3E- 1030 END .EQ $3E,3F ADDRESS OF END OF RANGE
40- 1040 PNTR .EQ $40,41,42 START OF RANGE, CURRENT PNTR
1050 *
0200- 1060 WBUF .EQ $200
0280- 1070 KBUF .EQ $280
02C0- 1080 MBUF .EQ $2C0
1090 *
FD8E- 1100 CROUT .EQ $FD8E
FDDA- 1110 PRBYTE .EQ $FDDA
FDED- 1120 COUT .EQ $FDED
1130 *
1140 T
0800- A9 0B 1150 LDA #SEARCH Setup Control-Y vector
0802- 8D F9 03 1160 STA $3F9
0805- A9 08 1170 LDA /SEARCH
0807- 8D FA 03 1180 STA $3FA
080A- 60 1190 RTS
1200 *
1210 SEARCH
080B- 20 45 08 1220 JSR GET.PATTERN Crack the search pattern
080E- B0 34 1230 BCS .99 ...nothing there or too long
0810- 8E 00 02 1240 STX WBUF save # bytes in pattern
1250 *---Compare pattern---
0813- A0 FF 1260 :1 LDY #-1
0815- C8 1270 :2 INY
0816- B1 40 1280 LDA (PNTR),Y Byte from source
0818- 59 80 02 1290 EOR KBUF,Y Byte from pattern
081B- 39 C0 02 1300 AND MBUF,Y Byte from mask
081E- D0 14 1310 BNE .3 ...does not pass inspection
0820- CC 00 02 1320 CPY WBUF At end of pattern yet?
0823- 90 F0 1330 BCC .2 ...no
1340 *---Found a match---
0825- A5 41 1350 LDA PNTR+1
0827- 20 DA FD 1360 JSR PRBYTE
082A- A5 40 1370 LDA PNTR
082C- 20 DA FD 1380 JSR PRBYTE
082F- A9 A0 1390 LDA #"
0831- 20 ED FD 1400 JSR COUT
1410 *---Slip to next position---
0834- A5 40 1420 :.3 LDA PNTR Set carry if at end of range
0836- C5 3E 1430 CMP END
0838- A5 41 1440 LDA PNTR+1
083A- E3 3F 1450 SBC END+1
083C- E6 40 1460 INC PNTR Bump comparison pointer
083E- DO 02 1470 BNE .4
0840- E6 41 1480 INC PNTR+1
0842- 90 CF 1490 :.4 BCC .1
1500 *
0844- 60 1510 :.99 RTS
1520 *
1530 GET.PATTERN
0845- A4 34 1540 LDY YSAVE
0847- A2 FF 1550 LDX #-1
0849- E8 1560 :.1 INX
084A- A9 FF 1570 LDA #$FF Assume mask =$FF
084C- 9D C0 02 1580 :.2 STA MBUF,X Store a mask value
084F- A9 00 1590 LDA #$00 Start Keybyte = $00
0851- 9D 80 02 1600 :.3 STA KBUF,X
0854- C0 7F 1610 CPY #$7F
0856- B0 3D 1620 BCS .7 ...LINE TOO LONG
0858- 20 A3 08 1630 JSR NXTCHR GET UPPER-CASE CHAR AT WBUF,Y
085B- C9 A0 1640 CMP "# " Is it a space?
085D- F0 EA 1650 BEQ .1 ...yes, next byte
085F- C9 BA 1660 CMP ":":
0861- 90 11 1670 BCC .5 < $BA, must be 0...9
0863- D0 05 1680 BNE .4 > $BA, must be A...F
0865- BD 80 02 1690 LDA KBUF,X = $BA, ":" means to put
0868- B0 E2 1700 BCS .2 ...ALWAYS value into MASK
1710 *---Try letter A...F---
086A- C9 C7 1720 :.4 CMP "#G"
086C- B0 27 1730 BCS .7 ...ERROR
086E- C9 C1 1740 CMP "#A"
0870- 90 23 1750 BCC .7 ...ERROR
0872- E9 07 1760 SBC #7 "A"..."F"

```

```

0874- C9 B0 1770 ----Try hex digit range-----
0876- 90 14 1780 .5 CMP #$0? Is it 0...9 or A...F?
0878- 29 0F 1790 BCC .6 ...no
087A- 1E 80 02 1800 AND #$0F ...yes, isolate digit
087D- 1E 80 02 1810 ASL KBUF,X Shift previous value
0880- 1E 80 02 1830 ASL KBUF,X
0883- 1E 80 02 1840 ASL KBUF,X
0886- 1D 80 02 1850 ORA KBUF,X Merge with digit
0889- 4C 51 08 1860 JMP .3
088C- C9 8D 1870 ----End of line or error-----
088E- D0 05 1880 .6 CMP #$8D ...ERROR
0890- 88 1890 BNE .7
0891- 84 34 1900 DEY
0893- 18 1910 STY YSAVE
0894- 60 1920 CLC
0895- 84 34 1930 RTS
0897- A9 8D 1940 ----Bad char or line too long----
0899- 99 01 02 1950 .7 STY YSAVE
0899- 99 01 02 1960 LDA #$8D STORE <RETURN> IN MONITOR
089C- A9 87 1970 STA WBUF+1,Y INPUT BUFFER
089E- 20 ED FD 1980 LDA #$87 RING THE BELL
08A1- 38 1990 JSR COUT
08A2- 60 2000 SEC INFORM OF ERROR
08A3- B9 00 02 2010 RTS
08A6- C8 2020 -----
08A7- C9 E1 2030 NXTCHR LDA WBUF,Y
08A9- 90 06 2040 INY
08AB- C9 FB 2050 CMP #$E1
08AD- B0 02 2060 BCC .1
08AF- 29 DF 2070 CMP #$FB
08B1- 60 2080 BCS .1
08B1- 60 2090 AND #$DF
08B1- 60 2100 :1 RTS
08B1- 60 2110 -----

```

EnterSoft

Basic-like macros for the S-C Macro Assembler.

Available for the Apple II, II+, //e, and //c.

Uses whatever DOS your S-C Macro Assembler uses.

Soon to be released for PRODOS.

Source code included with every disk!!!

Cost? A pastry \$30.00!!!

To Order - Send Check or Money Order to:



Mark Manning

c/o Baggy Games

P. O. Box 591894

Houston, Texas 77259-1894

Apple is a registered Trademark of Apple Computer Inc.

The S-C Macro Assembler is produced by The S-C Software Corporation.

EnterSoft is produced by Mark Manning/Simulacron I/Baggy Games



SPECIAL !!! EXPANDED RAM/ROM BOARD: \$39.00

Similar to our \$30 RAM/ROM dev board described below. Except this board has two sockets to hold your choice of 2-2K RAM, 2-2K ROM or even 2-4K ROM for a total of 8K. Mix RAM and ROM too. Although Apple limits access to only 2K at a time, soft switches provide convenient socket selection. Hard switches control defaults.

IMPROVED !!!][IN A MAC (ver 2.0): \$75.00

Now includes faster graphics, UniDisk support and more! Bi-directional data transfers are a snap! This Apple II emulator runs DOS 3.3/PRODOS (including 6502 machine language routines) on a 512K MAC or MACPLUS. All Apple II features are supported such as HI/LO-RES graphics, 40/80 column text, language card and joystick. Also included: clock, RAM disk, keyboard buffer, on-screen HELP, access to the desk accessories and support for 4 logical disk drives. Includes 2 MAC diskettes (with emulation, communications and utility software, plus DOS 3.3 and PRODOS system masters, including Applesoft and Integer BASIC) and 1 Apple II diskette.

SCREEN.GEN: \$35.00

Develop HI-RES screens for the Apple II on a Macintosh. Use MACPAINT (or any other application) on the MAC to create your Apple II screen. Then use SCREEN.GEN to transfer directly from the MAC to an Apple II (with SuperSerial card) or IIc. Includes Apple II diskette with transfer software plus fully commented SOURCE code.

MIDI-MAGIC for Apple //C: \$49.00

Compatible with any MIDI equipped music keyboard, synthesizer, organ or piano. Package includes a MIDI-out cable (plugs directly into modem port - no modifications required!) and 6-song demo diskette. Large selection of digitized QRS player-piano music available for 19.00 per diskette (write for catalog). MIDI-MAGIC compatible with Apple II family using Passport MIDI card (or our own input/output card w/drum sync for only \$99.00).

FONT DOWNLOADER & EDITOR: \$39.00

Turn your printer into a custom typesetter. Downloaded characters remain active while printer is powered. Use with any Word Processor program capable of sending ESC and control codes to printer. Switch back and forth easily between standard and custom fonts. Special functions (like expanded, compressed etc.) supported. Includes HIRES screen editor to create custom fonts and special graphics symbols. For Apple II, II+, //e. Specify printer: Apple Imagewriter, Apple Dot Matrix, C.Itoh 8510A (Prowriter), Epson FX 80/85, or Okidata 92/192.

* FONTS LIBRARY DISKETTE #1: \$19.00 contains lots of user-contributed fonts for all printers supported by the Font Downloader & Editor. Specify printer with order.

DISASM 2.2e : \$30.00 (\$50.00 with SOURCE Code)

Use this intelligent disassembler to investigate the inner workings of Apple II machine language programs. DISASM converts machine code into meaningful, symbolic source compatible with S-C, LISA, ToolKit and other assemblers. Handles data tables, displaced object code & even provides label substitution. Address-based triple cross reference generator included. DISASM is an invaluable machine language learning aid to both novice & expert alike. Don Lancaster says DISASM is "absolutely essential" in his ASSEMBLY COOKBOOK.

The 'PERFORMER' CARD: \$39.00 (\$59.00 with SOURCE Code)

Converts a 'dumb' parallel printer I/F card into a 'smart' one. Simple command menu. Features include perforation skip, auto page numbering with date & title, large HIRES graphics & text screen dumps. Specify printer: MX-80 with Graftrax-80, MX-100, MX-80/100 with Graftraxplus, NEC 8092A, C.Itoh 8510 (Prowriter), OkiData 82A/83A with OkiGraph & OkiData 92/93.

'MIRROR' ROM: \$25.00 (\$45.00 with SOURCE Code)

Communications ROM plugs directly into Novation's Apple-Cat Modem card. Basic modes: Dumb Terminal, Remote Console & Programmable Modem. Features include: selectable pulse or tone dialing, true dialtone detection, audible ring detect, ring-back, printer buffer, 80 col card & shift key mod support.

RAM/ROM DEVELOPMENT BOARD: \$30.00

Plugs into any Apple slot. Holds one user-supplied 2Kx8 memory chip (6116 type RAM for program development or 2716 EPROM to keep your favorite routines on-line). Maps into \$Cn00-\$nFF and \$C800-\$FFF.

C-PRINT For The APPLE //C: \$69.00

Connect standard parallel printers to an Apple //c serial port. Separate P/S included. Just plug in and print!

Unless otherwise specified, all Apple II diskettes are standard (not copy protected!) 3.3 DOS.

Avoid a \$3.00 handling charge by enclosing full payment with order. VISA/MC and COD phone orders OK.

RAK-WARE 41 Ralph Road W. Orange NJ 07052 (201) 325-1885



Reading the IIgs ROMs.....Bob Sander-Cederlof

A few days ago a friend and I were burning some EPROMs using the SCRG PromGramer in my IIgs. The friend said, "Why don't we use this card to read the IIgs ROM?" "We could put the PromGramer in another machine, and then put the IIgs ROMs in it and read them."

Well, I don't really know why he wanted to do this. He has his own IIgs already anyway. Nevertheless, I can think of reasons to want to capture all of the ROM info on disk files.

Disassembly, for one, using the S-C DisAssembler. Another reason would be to be able to compare different machines to see if they have the same ROM contents. But do we have to take out the chips to read them?

No. The following simple commands, issued from inside the S-C Macro Assembler running in your IIgs, will write the entire ROM contents to a series of eight files. It works under either ProDOS or DOS 3.3:

```
$00/1000<FE/0000.3FFFM  
BSAVE ROM.FE.0,A$1000,L$4000  
$00/1000<FE/4000.7FFFM  
BSAVE ROM.FE.4,A$1000,L$4000  
$00/1000<FE/8000.BFFFM  
BSAVE ROM.FE.8,A$1000,L$4000  
$00/1000<FE/C000.FFFFM  
BSAVE ROM.FE.C,A$1000,L$4000  
$00/1000<FF/0000.3FFFM  
BSAVE ROM.FF.0,A$1000,L$4000  
$00/1000<FF/4000.7FFFM  
BSAVE ROM.FF.4,A$1000,L$4000  
$00/1000<FF/8000.BFFFM  
BSAVE ROM.FF.8,A$1000,L$4000  
$00/1000<FF/C000.FFFFM  
BSAVE ROM.FF.C,A$1000,L$4000
```

I found it convenient to put those commands in a text file, which I named GET.ROMS. Then, whenever I want to use it, I can just type EXEC GET.ROMS. I took my disk down to the local Heathkit store around 10:45 this morning and came back with a copy of their ROM.

It strikes me just now that I am being inconsistent. Sometimes I am saying ROM, and sometimes ROMs. There is a reason....

Real IIgs machines come with one system ROM chip, which is a 1 megabit ROM. It holds all 128K bytes, in only one 28-pin package. I presume it uses pinouts like a 27512 EPROM, but selects one half or the other of the 1024K bits using what would normally be the programming pin on the 27512. My IIgs, on the other hand, is a prototype machine. It has an adapter plugged into the single ROM socket, which holds four 27256 EPROM chips and one 74F139. They call it the "airplane ROMs". I like it, because if I want to I can easily burn a new version of the firmware and plug it in. Some enterprising soul might find a market for a board like this.

More About Patching Apple's ProDOS Releases

You remember in our March issue we talked about patches to fix Version 1.3 of ProDOS. Apple has pulled this version off the market, but there are still a lot of copies floating around. The patches we gave in the March article should make ProDOS 1.3 as good as any other version, but who knows?

Anyway, we heard through the grapevine that some unofficial copies of version 1.4 are out, and that a brand new bug has surfaced in this one. It seems someone put a "LDA \$C09C,X" where "LDA \$C08E,X" should be.

I ran across a listing in the Washington Apple Pi newsletter (May 1987 issue, page 16) of an Applesoft program which can install all known necessary patches in versions 1.1.1, 1.2, 1.3, and 1.4 of ProDOS. The program was originally written by Stephen Thomas to fix version 1.1.1, when the problem of the four STA's to the stepper motor soft-switches was discovered. (See Nov 86 AAL) Later Glen Bredon modified it to make the corresponding patches to later versions, as well as to fix the additional new bugs. I have further modified it, in an attempt to make it easier to understand.

```
100 TEXT : HOME :E = 0: PRINT "PRODOS PATCH PROGRAM"
110 IF PEEK (116) < 128 THEN E = 1: GOTO 900: REM ENUF MEM?
120 ONERR GOTO 900
130 REM ---READ PRODOS FILE---
140 PRINT CHR$ (4)"UNLOCK PRODOS"
150 PRINT CHR$ (4)"BLOAD PRODOS TSYS,A$2000"
200 REM ---SEARCH $4000-$60FF FOR PATTERN---
210 V = 1: FOR B = 64 TO 96:A = B * 256
220 IF PEEK (A + 4) < > 189 THEN 250
230 IF PEEK (A + 5) < > 156 THEN 290
240 IF PEEK (A + 6) = 192 THEN V = 3:B = 96: GOTO 290: REM VERSION 1.4
250 IF PEEK (A + 4) < > 234 THEN 290
260 IF PEEK (A + 5) < > 234 OR PEEK (A + 6) < > 234 THEN 290
270 IF PEEK (A + 7) < > 234 OR PEEK (A + 8) < > 234 THEN 290
280 V = 2:B = 96: REM VERSION BEFORE 1.4
290 NEXT B:E = 2: ON V GOTO 900,300,700
300 REM ---FOUND VERSION BEFORE 1.4---
310 POKE A + 4,189: POKE A + 5,142: POKE A + 6,192: REM "LDA $C08E,X"
400 REM ---LOOK FOR OTHER PATCH AREA---
410 A = PEEK (A + 2) + 256 * PEEK (A + 3) - 13 * 4096 + A + 5
420 E = 3: IF A < 4 * 4096 OR A > 6 * 4096 THEN 900
430 IF PEEK (A) < > 157 OR PEEK (A + 1) < > 157 THEN 500
440 IF PEEK (A + 2) < > 157 OR PEEK (A + 3) < > 157 THEN 500
450 REM ---FOUND VERSION 1.1.1 OR 1.2, SO CHANGE "LDA" TO "STA"---
460 FOR I = 0 TO 9 STEP 3: POKE A + I,189: NEXT I
470 V$ = "1.1.1": GOTO 800
500 REM ---VERSION 1.3---
510 FOR I = 0 TO 12: READ B: IF PEEK (A + I) < > B THEN GOTO 900
520 NEXT I: DATA 160,8,189,128,192,232,232,136,208,248,234,234,96
530 FOR I = 0 TO 11: READ B: POKE A + I,B: NEXT I
540 DATA 189,128,192,189,130,192,189,132,192,189,134,192
550 A = 4 * 4096 + 12 * 256 + 12 * 16 + 13: REM ADDRESS = $4CCD
560 FOR I = 0 TO 3: READ B: IF PEEK (A + I) < > B THEN 900
570 NEXT I: POKE A,240: REM CHANGE "BRA" TO "BEQ"
580 V$ = "1.3": GOTO 800
590 DATA 128,6,190,0
```

```

700 REM ---VERSION 1.4---
710 POKE A + 5,142: REM "LDA $C09C,X" TO "LDA $C08E,X"
720 V$ = "1.4"
800 REM ---WRITE PATCHED VERSION ON DISK---
810 PRINT CHR$(4)"BSAVE PRODOS,TSYS,A$2000"
820 PRINT CHR$(4)"LOCK PRODOS"
830 PRINT "PATCHES COMPLETED TO VERSION "V$: END
900 REM ---ERROR HANDLER---
910 PRINT CHR$(7)"ERROR! NO PATCHES WERE MADE."
915 ON E GOTO 930,940,950
920 PRINT "PRODOS FILE NOT FOUND.": END
930 PRINT "NOT ENOUGH ROOM TO LOAD PRODOS.": END
940 PRINT "PATCH LOCATION NOT FOUND.": END
950 PRINT "PRODOS FILE MAY HAVE BEEN PATCHED."
960 PRINT "ALREADY, OR IS NOT A COMPATIBLE VERSION."
970 END

```

Lines 100-150 read the ProDOS system file into memory. Then Lines 200-290 search every page from \$4000 through \$60FF for either five NOPs starting at \$xx04 or a "LDA \$C09C,X" instruction at \$xx04. If neither is found, nothing is patched. If the five NOPs are found, we have version 1.1.1, 1.2, or 1.3. If the LDA is found, we have version 1.4. If it is version 1.4, the only patch needed is to change it to "LDA \$C08E,X", which is done at lines 700-720.

Older versions all need "LDA \$C08E,X" poked where the five NOPs were, so line 310 takes care of this. Then we look at the address in the operand field of the instruction just prior to the five NOPs. This is a JSR to a little subroutine which we need to modify. Line 410 computes the location within the system file image for the twelve bytes we need to change.

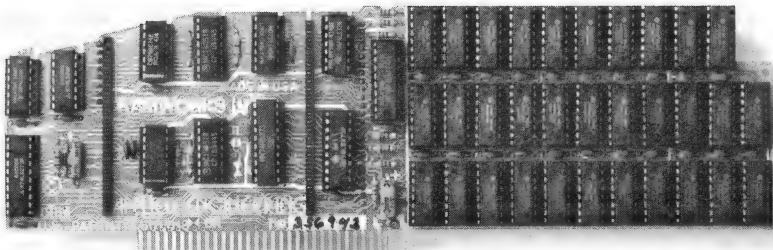
There are several possible versions of this subroutine. If it is a series of "STA \$C08x,X" instructions, we have version 1.1.1 or 1.2 and the STA opcodes should be changed to LDA opcodes. Lines 430 and 440 test for STA opcodes, and lines 450-470 make the changes. On the other hand, if the subroutine is like Apple put in version 1.3 we will replace it with a series of four LDAs just like we made in the older versions. Lines 500-590 handle this, and also change an errant "BRA" opcode to a "BEQ" opcode.

Finally, lines 800-830 write out the modified code and re-LOCK the file. I would be careful to check the changes made before doing this to every copy I own, if I were you. And bear in mind that Apple as a company has never authorized any of these changes. (They have only made them necessary, by their own incorrect changes.)

While this article was waiting for the press, Apple finally sent out correct copies of version 1.4. I received my master copy June 1st, and checked it against our patched version 1.3. They were identical except for the copyright dates and version numbers. The official date on this GOOD version 1.4 is April 17, 1987.

RamWorks® III

Patented Performance from the Recognized Leader



With battery backed RAM port, RGB port, increased memory capacity, full software compatibility and more compact design, RamWorks III is a generation ahead.

RamWorks III is the newest 3rd generation RAM card for the Apple IIe. It incorporates all of the technology and improvements that years of experience and over a hundred thousand sales have given us. By selling more memory cards than anyone else and listening to our customers, we were able to design a memory card that has the ultimate in performance, quality, compatibility and ease of use. A design so advanced it's patented. We call it RamWorks III, you'll call it awesome!

The AppleWorks Amplifier.

While RamWorks III is recognized by all memory intensive programs, NO other expansion card comes close to offering the multitude of enhancements to AppleWorks that RamWorks III does. Naturally, you'd expect RamWorks III to expand the available desktop, after all Applied Engineering was a year ahead of everyone else *including Apple* in offering more than 55K, and we still provide the largest AppleWorks desktops available. But a larger desktop is just part of the story. Look at all the AppleWorks enhancements that even Apple's own card does not provide and *only* RamWorks III does. With a 256K or larger RamWorks III, *all* of AppleWorks (including printer routines) will automatically load itself into RAM dramatically increasing speed by eliminating the time required to access the program disk drive. Switch from word processing to spreadsheet to database at the speed of light with no wear on disk drives.

Only RamWorks eliminates AppleWorks' internal memory limits, increasing the maximum number of records available from 1,350 to over 25,000. *Only* RamWorks increases the number of lines permitted in the word processing mode from 2,250 to over 15,000. And *only* RamWorks offers a built-in printer buffer, so you won't have to wait for your printer to stop before returning to AppleWorks. RamWorks even expands the clipboard. And auto segments large files so they can be saved on two or more disks. You can even have Pinpoint or MacroWorks and your favorite spelling checker in RAM for instant response.

RamWorks, *nothing* comes close to enhancing AppleWorks so much.

The Most Friendly, Most Compatible Card Available.

Using RamWorks III couldn't be easier because it's compatible with more off-the-shelf software than any other RAM card. Popular programs like AppleWorks, Pinpoint, Catalyst, MouseDesk, HowardSoft, FlashCalc, Pro-Filer, Managing Your Money, SuperCalc 3a, and MagicCalc to name a few (and *all* hardware add on's like ProFile and Sider hard disks). RamWorks is even compatible with software written for Apple cards. But unlike other cards, RamWorks plugs into the IIe auxiliary slot providing our super sharp 80 column text (U.S. Patent #4601018) in a completely integrated system while leaving expansion slots 1 through 7 available for other peripheral cards. RamWorks III is compatible with all

Apple IIe's, enhanced, unenhanced, American or European versions.

Highest Memory Expansion.

Applied Engineering has always offered the largest memory for the IIe and RamWorks III continues that tradition by expanding to 1 full MEG on the main card using standard RAMs, more than most will ever need (1 meg is about 500 pages of text)...but if you do ever need more than 1 MEG, RamWorks III has the widest selection of expander cards available. Additional 512K, 2 MEG, or 16 MEG cards just snap directly onto RamWorks III by plugging into the industry's only low profile (no slot 1 interference) fully decoded memory expansion connector. You can also choose non-volatile, power independent expanders allowing permanent storage for up to 20 years.

It Even Corrects Mistakes.

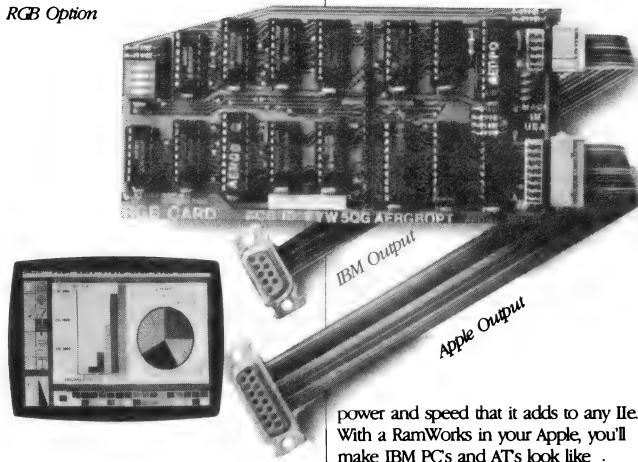
If you've got some other RAM card that's not being recognized by your programs, and you want RamWorks III, you're in luck. Because all you have to do is plug the memory chips from your current card into the expansion sockets on RamWorks to recapture most of your investment!

The Ultimate in RGB Color.

RGB color is an option on RamWorks and with good reason. Some others combine RGB color output with their memory cards, but that's unfair for those who don't need RGB *and* for those that do. Because if you don't need RGB

Applied Engineering doesn't make you buy it, but if you want RGB output you're in for a nice surprise because the RamWorks RGB option offers better color graphics plus a more readable 80 column text (that blows away any composite color monitor). For only \$129 it can be added to RamWorks giving you a razor sharp, vivid brilliance that most claim is the best they have ever seen. You'll also appreciate the multiple text colors (others only have green) that come standard. But the RamWorks RGB option is more than just the ultimate in color output because unlike others, it's fully compatible with all the Apple standards for RGB output control, making it more compatible with off-the-shelf software. With its FCC certified design, you can use almost any RGB monitor because only the new RamWorks RGB option provides both Apple standard and IBM standard RGB outputs (cables included). The RGB option plugs into the back of RamWorks with no slot 1 interference.

RGB Option



ference and remember you can order the RGB option with your RamWorks or add it on at a later date.

True 65C816 16 Bit Power.

RamWorks III has a built-in 65C816 CPU port for direct connection to our optional 65C816 card. The only one capable of linearly addressing more than 1 meg of memory for power applications like running the Lotus 1-2-3® compatible program, VIP Professional. Our 65C816 card does not use another slot but replaces the 65C02 yet maintains full 8 bit compatibility.

Endorsed by the Experts.

A+ magazine said "Applied Engineering's RamWorks is a boon to those who must use large files with AppleWorks... I like the product so much that I am buying one for my own system," in *Cider* magazine said "RamWorks is the most



Steve Wozniak, the creator of Apple Computer

"I wanted a memory card for my Apple that was fast, easy to use, and very compatible; so I bought RamWorks."

powerful auxiliary slot memory card available for your IIe, and I rate it four stars... For my money, Applied Engineering's RamWorks is king of the hill."

Apple experts everywhere are impressed by RamWorks's expandability, versatility, ease of use, and the sheer

- Built-in super sharp 80 column display, (U.S. Patent #4601018)
- Expandable to 1 MEG on main card
- Expandable to 16 meg with expander cards, with NO slot 1 interference
- Can use 64K or 256K RAMs
- Powerful linear addressing 16 bit coprocessor port
- Automatic AppleWorks expansion up to 3017K desktop
- Accelerates AppleWorks
- Built in AppleWorks printer buffer
- The only large RAM card that's 100% compatible with all IIe software
- RamDrive™ the ultimate disk emulation software included free
- Memory is easily partitioned allowing many programs in memory at once
- Compatible, RGB option featuring ultra high resolution color graphics and multiple text colors, with cables for both Apple and IBM type monitors
- Built-in self diagnostics software
- Lowest power consumption (U.S. Patent #4601018)
- Takes only one slot (auxiliary) even when fully expanded
- Socketed and user upgradeable
- Software industry standard
- Advanced Computer Aided Design
- Used by Apple Computer, Steve Wozniak and virtually all software companies
- Displays date and time on the AppleWorks screen with any PRO-DOS compatible clock
- Much, much more!

RamWorks III with 64K	\$179
RamWorks III with 256K	\$199
RamWorks III with 512K	\$249
RamWorks III with 1 MEG	\$329
RamWorks III with 1.5 MEG	\$489
RamWorks III with 2 to 16 MEG	CALL 65C816 16 BIT Card
	\$159
RGB Option	\$129
Optional Software:	
Pinpoint with RAM Enhancement Software	\$79
VIP Professional	\$219

RamWorks III. The industry standard for memory expansion of the Apple IIe. ORDER YOUR RamWorks III TODAY. See your dealer or call (214) 241-6060, 9 a.m. to 11 p.m., 7 days, or send check or money order to Applied Engineering. MasterCard, Visa and C.O.D. welcome. Texas residents add 6 1/4% sales tax. Add \$10.00 if outside U.S.A.

AE Applied Engineering
P.O. Box 798, Carrollton, TX 75006
(214) 241-6060

ABC*DE=FG*HI Puzzle Solved.....Bob Sander-Cederlof

A+ Magazine has an interesting puzzle each month, with a challenge to solve it with your Apple and possibly win a prize. The June 1987 puzzle (see page 110, "Computer Calisthenics" by Michael Wiesenberg) involves writing a program to find all possible solutions to the equation ABC*DE=FG*HI, where each letter represents a different digit between 1 and 9. All nine digits are different.

I wrote a quick-and-dirty program in Applesoft, and then refined it a little for speed. Maybe speed isn't the correct work, because even the refined result takes nearly six minutes to find the eleven solutions. The first solution my program found was the same as the one example solution given in the A+ article: $158*23 = 46*79$.

Puzzles of this type can be solved, if you have enough time, by trying all possible combinations. A series of nested FOR loops, one for each digit, will produce all possible nine-digit arrangements. Appropriate tests can weed out all values which have more than one letter sharing the same digit. Inside all the loops you test the letter assignments against the puzzle equation, and print the solution if it passes.

This will take way too long, even on a computer, so you start looking for ways to eliminate some combinations. The first thing I noticed is that I can eliminate symmetric solutions by forcing HI>FG. This means H>F, so I can run my FOR loop for H from F+1 to 9, instead of from 1 to 9.

The smallest possible value for abc*de is $245*13=3185$. This means F cannot be 1 or 2, because even $29*99$ is too small. A little more examination shows that FG must be at least 34, so I put this into my program.

Neither C nor E can be 5, because this would force either G or I to also be 5. I also notice that you cannot have a 1 on the right-hand side of the puzzle equation. If there were a 1 there, the largest possible FG*HI would be $91*87 = 7917$. This is still smaller than the smallest possible left-hand side without a 1 ($356*24 = 8544$), so it cannot work.

Similar analysis shows that D cannot be 8 or 9. The largest possible FG*HI is $87*96 = 8352$. If D is 8, the smallest ABC*DE is $134*82 = 10988$; D=9 is even worse. This also cannot work, so I limit my D-loop to values from 1 to 7.

I also refined the program in the area of testing whether a digit has already been used by a previous letter. I maintain an array of flags. At the top of each loop I test the flag array entry to see if the digit has already been used. If not, I mark it used and continue. If it is already in use, I skip around all the inner loops to the corresponding NEXT. Here is the Applesoft version of my program:

```

10 DIM N(9): FOR I = 1 TO 9:N(I) = I: NEXT :EPS = .0001
100 FOR F = 3 TO 8:N(F) = 0
110 FOR GX = 2 TO 9:G = N(GX): IF G = 5 OR G = 0 THEN 320
115 FG = F * 10 + G: IF FG < 34 THEN 320
120 N(GX) = 0: FOR HX = F + 1 TO 9:H = N(HX): IF H = 0 THEN 310
130 N(HX) = 0: FOR IX = 2 TO 9:I = N(IX): IF I = 0 OR I = 5 THEN 300
140 HI = H * 10 + I:P = FG * HI: IF P < 3240 THEN 300
150 N(HX) = 0: FOR DX = 1 TO 8:D = N(DX): IF D = 0 THEN 290
160 N(DX) = 0: FOR EX = 1 TO 9:E = N(EX): IF E = 0 OR E = 5 THEN 280
170 DE = D * 10 + E:Q = P / DE: IF Q < 123 OR Q < > INT(Q + EPS) THEN 280
180 N(EX) = 0:A = INT(Q / 100 + EPS): IF N(A) = 0 THEN 270
190 N(A) = 0:B = INT(Q / 10 - A * 10 + EPS): IF N(B) = 0 THEN 260
200 N(B) = 0:C = INT(Q - A * 100 - B * 10 + EPS): IF N(C) = 0 THEN 250
210 N = N + 1: PRINT SPC(N < 10);N": "FG" X "HI" = "DE" X "Q" = "P
250 N(B) = B
260 N(A) = A
270 N(EX) = EX
280 NEXT EX:N(DX) = DX
290 NEXT DX:N(IX) = IX
300 NEXT IX:N(HX) = HX
310 NEXT HX:N(GX) = GX
320 NEXT GX:N(F) = F: NEXT F

```

I wanted to see how hard it would be to re-write the above program in assembly language, and if so how much speedier it would be. I am not proud that it took me over four hours to perfect the assembly language version. But the result is nice. It executes in less than seven seconds! This does not necessarily argue well for assembly language programming, if all I care about is the answers to the puzzle. But if I view it as an example, and consider that the same speedup may be possible in much larger and much more frequently used programs, it does make assembly language look good. That is why programs like the S-C Macro Assembler and even the Applesoft firmware itself are written in assembly language.

I used the same overall approach in assembly language version. Lines 1040-1090 initialize an array of flags I use to quickly check whether a digit is already in use. The flag values are either 0 or 1: 0 means a digit is in use, and 1 means it is available. The array is accessed by using the digit value for an index. I can both test a flag and change it to zero with one instruction: LSR FLAGS,X will shift bit 0 into carry. If the flag was 0, it still is and carry is clear. If the flag was 1 it changes to 0 and carry is set.

Lines 1110-1520 are a equivalent of FOR statements, starting up a series of six nested loops to generate values for D, E, F, G, H, and I. Lines 1580-1880 are the equivalent to the NEXT statements. All the flag array handling is also included in these two groups of lines. I put the prior knowledge about the ranges of possible values for these six letters into the FOR-loop values, and eliminate the value 5 for letters E, G, and I.

Lines 1540-1560 call subroutines to test the choices for letters D through I and print the resulting equation if it is a valid solution to the puzzle. Both of these subroutines use some really interesting techniques.

The PRINT subroutine (lines 2820-3060) is controlled by a

format string in lines 3080-3160. This string has two kinds of bytes: index values between 0 and 8, and ASCII characters between 80 and FF. The index values point to the table of digits A through I. The print loop, lines 2840-2910, only needs four extra lines to pick up digits out of the digit table and convert them to ASCII. Line 2850 branches directly to the JSR COUT in line 2890 if the format byte is an ASCII character already. Otherwise, lines 2860-2880 use the format byte as an index to pick up the digit and merge \$B0 with it to convert it to ASCII. This is not only neat, it is also short and fast. Lines 2940-3050 allow you to pause and abort the program by typing any key to pause, <RETURN> to abort.

The COMPUTE.ABC subroutine (lines 1920-2710) checks the chosen values for D through I to see if they are a valid solution to the puzzle. If they are, values for A, B, and C will be chosen in the process of the check. Then the subroutine returns with carry clear to indicate a valid solution. If the solution is not valid, the subroutine will return with carry set.

Lines 1930-2010 call on CALC.XX (lines 2730-2800) to calculate binary values for DE, FG, and HI. I could have added a test here to be sure that $DE > 33$, but it did not seem to be worth the effort. I didn't try it, though, so I might be wrong. CALC.XX multiplies the first of each pair of digits by ten, and then adds the second.

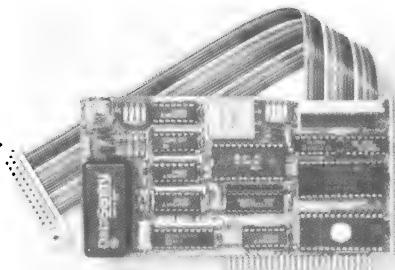
Lines 2020-2160 compute $WXYZ = FG \cdot HI$. The highest possible value for FG will be 79 and for HI will be 98. Since we are limiting F to the range 1 through 7, the largest possible combination will be $78 \cdot 96 = 7488$. This is \$1D40. The calculation is a simple 8-bit by 8-bit multiplication, with a 16-bit result.

Lines 2170-2330 compute $ABC = (FG \cdot HI) / DE$. I could have used two or three more nested loops to pick values for A, B, and C, but "it seemed like a good idea at the time" to do it this way. Now I think two more loops to pick A and B using the same techniques as for the other letters, plus a simple search through the flags to pick C, would be nicer. You might try it that way and compare the speeds of the two approaches. My calculation is a simple division with a 16-bit dividend, 8-bit divisor, 16-bit quotient, and 8-bit remainder. If the remainder is non-zero, then the numbers picked do not form a valid solution.

Lines 2340-2460 determine the value of A by essentially dividing ABC by 100. ABC is a 16-bit value, so the subtraction loop has to do a 16-bit subtraction. The loop subtracts one extra time, so line 2440 corrects the remainder (which will be the value BC). Lines 2450-2460 check to see if the value for A was already used for D through I.

Lines 2480-2580 do a similar operation to separate out the value of B, and by default leave the value of C in the A-register. Lines 2540-2570 check to see if the value for B was already used for D through I or for A. Finally, lines 2590-2660 check the value for C against all the other choices.

Serial Pro® The intelligent multifunction card from Applied Engineering.



Serial Pro is a powerful multifunction card for the Apple IIe, II+, IIcs and compatible computers. Serial Pro combines a powerful serial port for interfacing to a printer, modem or other serial device, with a full function clock/calendar. Serial Pro's serial port is compatible with virtually all letter quality and dot matrix printers, including Apple's Imagewriter and Imagewriter II, and can communicate with the fastest external modems at baud rates from 50 to 19,200.

Set up is easy, because unlike other cards, there are no switches to program serial parameters or disks to use. Serial Pro has a built-in setup screen that allows all parameters to be set. And on-screen help that makes it super-easy. An on-board battery stores your selections for over 20 years, but you can change them at any time. Serial Pro is the perfect upgrade for Super Serial card owners looking for more performance or a built-in clock.

Serial Port Features • Fully Super Serial Card compatible but more versatile and easier to use • Compatible with printers • Compatible with modems • Prints graphics to printer (without software) in nominal mode, 90° rotation, double size, side by side, and black/white inversion • Variable word length, number of stop bits and parity selection • Crystal controlled circuits are used to provide ultra accurate baud rates.

Clock Calendar Features • ProDOS, DOS and AppleWorks compatible. Displays time and date on the AppleWorks screen • Automatically time and date stamps AppleWorks files • 20 year auto recharging nickel-cadmium battery • Realtime interrupts • Built-in screen time and date settings (no software needed) • Does not use phantom slots.

Serial Pro is perfect for Apple IIe, II+, IIcs or compatible owners in need of a serial port or clock/calendar or both. But unlike other multifunction cards on the market, Serial Pro does not use phantom slots, so all the slots in your computer are useable.

Serial Pro comes complete with manual, cable and instructions for connecting to all the leading printers and modems. Serial Pro \$159

Order Today! See your dealer or call Applied Engineering, 9 a.m. to 11 p.m. 7 days. Or send check or money order to Applied Engineering, MasterCard, VISA and C.O.D. welcome. Texas residents add 5 1/2% sales tax. Add \$10.00 outside U.S.A.

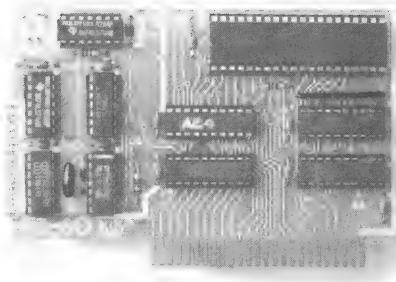
AE APPLIED ENGINEERING™

The Apple enhancement experts

(214) 241-6060

P.O. Box 798, Carrollton, TX 75006

With the Z-80 Plus, run over 5000 new CP/M® programs.



*Now, get two computers
in one, and all the
advantages of both.*

Enter the CP/M world with the new Z-80 Plus card from Applied Engineering, and introduce your Apple IIe, IIcs or II+ to thousands of CP/M programs. Only the Z-80 Plus comes standard with the new 5.1 software, the most advanced system ever for running CP/M programs.

The new 5.1 boasts advanced features like built-in disk emulation for popular memory expansion boards, boosting both system speed and storage capacity. And menu-driven utilities that let you get to work faster. The Z-80 Plus also lets you run older CP/M programs—all the way down to Version 1.6 (2.2 is the most popular).

The Z-80 Plus is the only card on the market capable of accessing more than 64K. If you have an extended 80-column card, all 128K is usable. And if you have RamWorks, RamFactor, or RAMplus, or an Apple memory card in your IIe, IIcs or II+, up to 1088K is available.

Each Z-80 Plus comes with our CP/M Ram Drive software, enabling most memory cards to work as a high-speed Ram disk so CP/M software can run up to twenty times faster. So packages like WordStar, dBASE II, Turbo Pascal and most others run at blinding speed.

Simply plug the Z-80 Plus into any slot in your Apple. You'll get the benefits of two computers in one—all at an unbelievably low price (only \$149!).

- Fully compatible with ALL CP/M software
- Fully compatible with 5 1/4" and 3 1/2" disk drives as well as most hard disks including the Sider
- Fully compatible with Microsoft disks (no pre-boot required)
- Specifically designed for high speed operation
- Runs WordStar, dBASE II, Turbo Pascal, and ALL other CP/M software with no pre-boot
- Semi-custom I.C. and low parts count allows Z-80 Plus to fly through CP/M programs with extremely low power consumption (we use the Z-80B)
- Does EVERYTHING other Z-80 boards do, plus Z-80 interrupts
- Five-year warranty

To get your Z-80 Plus or for more information see your dealer, or call 214-241-6060 9 a.m. to 11 p.m. seven days, or send check or money order to Applied Engineering, MasterCard, VISA and C.O.D. welcome. Texas residents add 5 1/2% sales tax. Add \$10.00 outside U.S.A.

AE Applied Engineering™

P.O. Box 798, Carrollton, TX 75006

(214) 241-6060

CPM is a registered trademark of Digital Research

As a final product, a program like this has little value (unless you win the contest!). However, it can be a great tool for perfecting your skill as a programmer. It is also a pleasant and harmless form of recreation. If you enjoy articles like these, let us know: we may do some more. Or, how about sending us one yourself?

```

1000 *SAVE S.PUZZLE
1010 *
1020 COUT .EQ $FDED
1030 *
1040 T
0800- A2 09 1050 LDX #9
0802- A9 01 1060 LDA #1      STORE 1 IN EACH FLAG
0804- 9D AC 09 1070 .1 STA FLAGS,X
0807- CA 1080 DEX
0808- DO FA 1090 BNE .1
1100 *
080A- A2 02 1110 LDX #2      FOR F=3 TO 8
080C- E8 1120 LOOP.F INX
080D- 8E A0 09 1130 STX F
0810- 5E AC 09 1140 LSR FLAGS,X mark digit in use
1150 *
0813- E0 03 1160 CPX #3      IF F=3, START G-LOOP AT 4
0815- F0 02 1170 BEQ LOOP.G
0817- A2 01 1180 LDX #1      FOR G=2 TO 9
0819- E8 1190 LOOP.G INX
081A- 5E AC 09 1200 LSR FLAGS,X
081D- 90 72 1210 BCC NEXT.G ...DIGIT ALREADY USED
081F- 8E A1 09 1220 STX G
0822- E0 05 1230 CPX #5
0824- F0 65 1240 BEQ FIX.G   G can't be 5
1250 *
0826- AE A0 09 1260 LDX F      FOR H=F+1 TO 9
0829- E8 1270 LOOP.H INX
082A- 5E AC 09 1280 LSR FLAGS,X
082D- 90 58 1290 BCC NEXT.H ...DIGIT ALREADY USED
082F- 8E A2 09 1300 STX H
1310 *
0832- A2 01 1320 LDX #1      FOR I=2 TO 9
0834- E8 1330 LOOP.I INX
0835- 5E AC 09 1340 LSR FLAGS,X
0838- 90 43 1350 BCC NEXT.I ...DIGIT ALREADY USED
083A- 8E A3 09 1360 STX I
083D- E0 05 1370 CPX #5
083F- F0 36 1380 BEQ FIX.I   I can't be 5
1390 *
0841- A2 00 1400 LDX #0      FOR D=1 TO 7
0843- E8 1410 LOOP.D INX
0844- 5E AC 09 1420 LSR FLAGS,X
0847- 90 2A 1430 BCC NEXT.D ...DIGIT ALREADY USED
0849- 8E 9E 09 1440 STX D
1450 *
084C- A2 00 1460 LDX #0      FOR E=1 TO 9
084E- E8 1470 LOOP.E INX
084F- 5E AC 09 1480 LSR FLAGS,X
0852- 90 15 1490 BCC NEXT.E ...DIGIT ALREADY USED
0854- 8E 9F 09 1500 STX E
0857- E0 05 1510 CPX #5
0859- F0 08 1520 BEQ FIX.E   E can't be 5
1530 *
085B- 20 A6 08 1540 JSR COMPUTE.ABC
085E- B0 03 1550 BCS FIX.E ...NOT AN ANSWER
0860- 20 58 09 1560 JSR PRINT
1570 *
0863- AE 9F 09 1580 FIX.E LDX E      NEXT E (1...9)
0866- FE AC 09 1590 INC FLAGS,X
0869- E0 09 1600 NEXT.E CPX #9
086B- 90 E1 1610 BCC LOOP.E
1620 *
086D- AE 9E 09 1630 FIX.D LDX D      NEXT D (1...7)
0870- FE AC 09 1640 INC FLAGS,X
0873- E0 07 1650 NEXT.D CPX #7
0875- 90 CC 1660 BCC LOOP.D
1670 *
0877- AE A3 09 1680 FIX.I LDX I      NEXT I (2...9)
087A- FE AC 09 1690 INC FLAGS,X

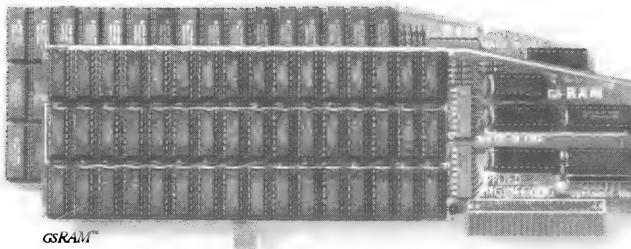
```

087D- EO 09	1700	NEXT.I CPX #9
087F- 90 B3	1710	BCC LOOP.I
	1720	*
0881- AE A2 09	1730	-----
0884- FE AC 09	1740	FIX.H LDX H NEXT H (F+1...9)
0887- EO 09	1750	INC FLAGS,X
0889- 90 9E	1760	NEXT.H CPX #9
	1770	BCC LOOP.H
088B- AE A1 09	1780	*
088E- FE AC 09	1790	FIX.G LDX G NEXT G (2...9)
0891- EO 09	1800	INC FLAGS,X
0893- BO 03	1810	NEXT.G CPX #9
0895- 4C 19 08	1820	BCS FIX.F
	1830	JMP LOOP.G
0898- AE A0 09	1840	*
089B- FE AC 09	1850	FIX.F LDX F NEXT F (3...8)
089E- EO 08	1860	INC FLAGS,X
08A0- BO 03	1870	NEXT.F CPX #8
08A2- 4C OC 08	1880	BCS END
	1890	JMP LOOP.F
08A5- 60	1900	*
	1910	END RTS END OF PROGRAM
	1920	*
	1930	COMPUTE.ABC
08A6- A2 03	1940	LDX #D-DIGITS DE = D#10+E
08A8- 20 4B 09	1950	JSR CALC.XX
08AB- 8D A4 09	1960	STA DE
08AE- A2 05	1970	LDX #F-DIGITS FG = F#10+G
08B0- 20 4B 09	1980	JSR CALC.XX
08B3- 8D A5 09	1990	STA FG
08B6- A2 07	2000	LDX #H-DIGITS HI = H#10+I
08B8- 20 4B 09	2010	JSR CALC.XX
08BB- 8D A6 09	2020	STA HI
	2030	-----
08BE- AO 08	2040	WXYZ = FG * HI multiply 8-bits by 8-bits
08CO- A9 00	2050	LDA #0
08C2- 4E A5 09	2060	.1 LSR FG get next bit of multiplier
08C5- 90 04	2070	BCC .2 bit = 0
08C7- 18	2080	CLC bit = 1
08C8- 6D A6 09	2090	ADC HI Add multiplicand
08CB- 6A 09	2100	ROR ROR WXYZ Shift product hi-byte
08CC- 6E A7 09	2110	ROR WXYZ product lo-byte
08CF- 88	2120	DEY Next bit
08D0- DO FO	2130	BNE .1 ...more to go
08D2- 8D A8 09	2140	STA WXYZ+1 store hi-byte of product
08D5- 8D AA 09	2150	STA ABC+1
08D8- AD A7 09	2160	LDA WXYZ
08DB- 8D A9 09	2170	STA ABC
	2180	-----
08DE- AO 10	2190	ABC = WXYZ / DE
08EO- A9 00	2200	LDY #16
08E2- 18	2210	LDA #0
08E3- 2E A9 09	2220	CLC
08E6- 2E AA 09	2230	ROL ABC ROL ABC+1
08E9- 2A	2240	ROL
08EA- CD A4 09	2250	CMP DE
08ED- 90 03	2260	BCC .4
08EF- ED A4 09	2270	SBC DE
08F2- 88	2280	DEY
08F3- DO EE	2290	BNE .3
08F5- 2E A9 09	2300	ROL ABC ...final bit into quotient
08F8- 2E AA 09	2310	ROL ABC+1
08FB- 8D AB 09	2320	STA REM
08FE- C9 01	2330	CMP #1 If any remainder, not a valid answer
0900- BO 47	2340	BCS .9
	2350	-----
0902- A2 FF	2360	Check digits of ABC
0904- AD A9 09	2370	LDX #-1
0907- AC AA 09	2380	LDA ABC
090A- 38	2390	LDY ABC+1
090B- E8	2400	SEC
090C- E9 64	2410	INX COUNT 100'S
090E- BO FB	2420	SBC #100
0910- 88	2430	BCS .5
0911- 10 F7	2440	DEY
0913- 69 64	2450	BPL .45
0915- BC AC 09	2460	ADC #100 CORRECT FOR OVER-SUBTRACTION
0918- FO 2F	2470	LDY FLAGS,X SEE IF DIGIT ALREADY USED
091A- 8E 9B 09	2480	BEQ .9 ...YES, NO NEED TO LOOK FURTHER
091D- A2 FF	2490	STX A
091F- 38	2490	LDX #-1
	2490	SEC

Insist on gSRAM™ When You Buy Your IIgs™

Expand the IIgs RAM and ROM with the gSRAM or gSRAM Plus with ROM Pak Available now with 256K to 8 MEG!

gSRAM Plus™



Remember the 16K cards for the II+ and the 64K cards for the IIe? At the time, that much memory seemed like a lot. But when the owners of these memory cards came to us for more memory, many had to throw away their smaller Apple memory cards or try to sell them. Most of our customers told us that had they known about Applied Engineering's larger memory cards when they bought their Apple, they would have purchased them at the same time.

gSRAM and gSRAM Plus are available now, allowing up to 8 MEG of memory expansion. That's 8 times the memory capacity of Apple's card and just look at the benefits that only gSRAM and gSRAM Plus have over Apple's card:

- Lower cost
- Has 6 RAM banks (Apple's card has 4)
- Has memory expansion port
- Has ROM expansion port
- No configuration blocks to set
- No soldered in RAM chips
- Expandable to 8 MEG
- Expands AppleWorks internal limits
- Built-in Hi-Res self-diagnostic software
- 5 year hassle free warranty (Apple has a 90 day warranty)
- Made in USA

gSRAM for More AppleWorks Power

Only gSRAM and gSRAM Plus eliminate AppleWorks internal memory limits, increasing the maximum number of records available from 6,000 to over 25,000 and only gSRAM and gSRAM Plus increase the number of lines permitted in the word processing mode from 6,000 to over 15,000. And only gSRAM and gSRAM Plus offer a built-in printer buffer so you can continue using Appleworks while your printer is printing. gSRAM and gSRAM Plus even expand the number of lines in the clipboard from 255 to 2047 and will auto segment large files so they can be saved on two or more disks. You can

even have Pinpoint or Macroworks and your favorite spelling checker in RAM for instant response. gSRAM and gSRAM Plus will even display the time and date right on the AppleWorks screen. Nothing comes close to enhancing AppleWorks so much.

Turn Your IIgs into a Giant

Simply plug gSRAM into the IIgs memory expansion slot and you've got up to 8 megabytes of RAM at your fingertips—all of it instantly and automatically recognized by the IIgs. gSRAM is compatible with all IIgs software, including AppleWorks, as well as BASIC®, ProDOS, DOS 3.3, PASCAL®, "C" and CP/M®.

Grow by Bytes or Megabytes

We offer gSRAM in two configurations so you can increase your memory 256K at a time (gSRAM) or a megabyte at a time (gSRAM Plus). Both offer full compatibility, lower cost than other boards, and easy expandability. And both are extremely low in power consumption. A fully expanded gSRAM operates at only 375 mA, and gSRAM Plus at only 270 mA (even with 6 megabytes on board!).

gSRAM—for Normal Memory Requirements

gSRAM is available with 256K, 512K, 1 MEG or 1.5 MEG of memory already on board. If you don't need the full 1.5 MEG now, you can choose a gSRAM with less memory and expand it up to 1.5 MEG in the future—or upgrade to gSRAM Plus for a small charge.



Steve Wozniak, the creator of Apple Computer

"In quality, performance, compatibility, expandability and support, Applied Engineering's gSRAM and gSRAM Plus are number one."

With an optional piggyback card, you can expand gSRAM even higher than 1.5 MEG! (Other cards are only expandable to 1 MEG.)

gSRAM Plus—for Growing by Leaps and Bounds

gSRAM Plus is the first Apple memory card to use 1 MEG RAM chips on the main board. It's available with 1 to 6 MEG on board. If you don't need the whole 6 MEG now, you can buy a gSRAM Plus with less memory and easily expand it in the future.

gSRAM Plus can be expanded up to 8 MEG with an optional piggyback card.

Easy Expansion

Both gSRAM and gSRAM Plus use standard RAM chips that are readily available and just plug right in. So unlike other cards, you'll find expanding your gSRAM or gSRAM Plus easy, convenient and very economical. And with our optional ROM expansion module you can even increase the IIgs's ROM space and all in just one slot.

Quality and Support of the Industry Leader

Applied Engineering is the largest supplier of Apple peripherals in the world. We invented the first large RAM cards for the Apple. With a 5-year "no-hassle" warranty and outstanding technical support, you can be sure gSRAM and gSRAM Plus will deliver the performance you're looking for—or return them within 15 days for a full refund.

gSRAM with 256K	\$169
gSRAM with 512K	\$219
gSRAM with 1 MEG	\$299
gSRAM with 1.5 MEG	\$379
gSRAM with 2.6 MEG	CALL
gSRAM PLUS with 1 MEG	\$459
gSRAM PLUS with 2 MEG	\$759
gSRAM PLUS with 3.8 MEG	CALL

Order today!

See your dealer or call Applied Engineering today, 9 a.m. to 11 pm, 7 days. Or send check or money order to Applied Engineering, MasterCard, VISA and C.O.D. welcome. Texas residents add 6½% sales tax. Add \$10.00 outside U.S.A.

AE APPLIED ENGINEERING™

The Apple enhancement experts.

(214) 241-6060

P.O. Box 798, Carrollton, TX 75006

CP/M is a registered trademark of Digital Research, Inc.

```

0920- E8      2500 .6      INX      COUNT 10'S
0921- E9 0A    2510          SBC #10
0923- B0 FB    2520          BCS .6
0925- 69 OA    2530          ADC #10      CORRECT FOR OVER-SUBTRACTION
0927- BC AC 09  2540          LDY FLAGS,X SEE IF DIGIT ALREADY USED
092A- F0 1D    2550          BEQ .9     ...YES, NO NEED TO LOOK FURTHER
092C- EC 9B 09  2560          CPX A
092F- F0 18    2570          BEQ .9
0931- 8E 9C 09  2580          STX B
0934- AA      2590          TAX
0935- BC AC 09  2600          LDY FLAGS,X SEE IF DIGIT ALREADY USED
0938- F0 0F    2610          BEQ .9     ...YES, NOT A SOLUTION
093A- EC 9B 09  2620          CPX A
093D- F0 0A    2630          BEQ .9
093F- EC 9C 09  2640          CPX B
0942- F0 05    2650          BEQ .9
0944- 8E 9D 09  2660          STX C     ...NO, WE HAVE A SOLUTION
0947- 18      2670 *-----*
0948- 60      2680          CLC
0949- 38      2690          RTS
094A- 60      2700 .9       SEC
094A- 60      2710          RTS
094B- BD 9B 09  2720 *-----*
094E- 0A      2730 CALC.XX
094F- 0A      2740          LDA DIGITS,X
0950- 7D 9B 09  2750          ASL
0953- 0A      2760          ASL
0954- 7D 9C 09  2770          ADC DIGITS,X
0955- 0A      2780          ASL
0957- 60      2790          ADC DIGITS+1,X
0958- A0 00    2800          RTS
0958- B9 88 09  2810 *-----*
095A- 30 06    2820 PRINT
095D- 30 06    2830          LDY #0
095F- AA      2840 .1       LDA FORMAT,Y
0960- BD 9B 09  2850          BMI .2
0963- 09 B0    2860          TAX
0960- BD 9B 09  2870          LDA DIGITS,X
0963- 09 B0    2880          ORA "#0"
0965- 20 ED FD  2890 .2       JSR COUT
0968- C8      2900          INY
0969- C0 13    2910          CPY #FMT.SZ
096B- 90 ED    2920          BCC .1
096D- AD 00 CO  2930 *-----*
0970- 10 15    2940          LDA $C000
0972- 8D 10 CO  2950          BPL .5
0975- C9 8D    2960          STA $C010
0977- F0 OC    2970          CMP #$8D
0979- AD 00 CO  2980          BEQ .4
0979- AD 00 CO  2990 .3       LDA $C000
097C- 10 FB    3000          BPL .3
097E- 8D 10 CO  3010          STA $C010
0981- C9 8D    3020          CMP #$8D
0983- D0 02    3030          BNE .5
0985- 68      3040 .4       PLA      POP RETURN, SO RTS QUILTS
0986- 68      3050          PLA
0987- 60      3060 .5       RTS
0988- 00 01 02  3070 *-----*
098B- A0 D8 A0  3080 FORMAT .HS 00.01.02      ABC
098E- 03 04    3090          .AS " X "      times
098E- 03 04    3100          .HS 03.04      DE
0990- A0 BD A0  3110          .AS " = "
0993- 05 06    3120          .HS 05.06      FG
0995- A0 D8 A0  3130          .AS " X "      times
0998- 07 08    3140          .HS 07.08      HI
099A- 8D      3150          .HS 8D
13-          3160          FMT.SZ .EQ "-FORMAT
13-          3170 *-----*
099B-          3180 DIGITS
099C-          3190 A   .BS 1
099D-          3200 B   .BS 1      09A4-
099D-          3210 C   .BS 1      09A5-
099E-          3220 D   .BS 1      09A6-
099F-          3230 E   .BS 1      09A7-
09A0-          3240 F   .BS 1      09A9-
09A1-          3250 G   .BS 1      09AB-
09A2-          3260 H   .BS 1
09A3-          3270 I   .BS 1      09AC-
09A3-          3280 *-----*
099B-          3290 DE   .BS 1
099C-          3300 FG   .BS 1
099D-          3310 HI   .BS 1
099E-          3320 WXYZ  .BS 2
099F-          3330 ABC  .BS 2
09A0-          3340 REM  .BS 1
09A1-          3350 *
09A2-          3360 FLAGS .BS 10
09A3-          3370 *

```

Problem with IIgs 3.5"-Drive Firmware.....Bob Sander-Cederlof

The firmware in the IIgs for the 3.5"-drive includes the so-called "Protocol Converter" interface. We discussed this interface a little in previous issues, especially in the May 1986 article showing how to make DOS 3.3 work with the little drives.

Last month we reported a fix you need to make to our DOS 3.3 patches if you want it to work on a IIgs. Then last week I found out about another IIgs-related problem.

The 3.5"-drive firmware in the IIgs, when you call it through the Protocol Converter interface, stomps on four pagezero locations which are used by other programs. Locations \$57, 58, 59, and 5A all are used without any concern for how they might already be in use. The firmware makes a great effort to save and restore all sorts of other locations, but these it just walks over, kicking sand like the big bully at the beach.

We first noticed the problem when using the S-C Macro Assembler with our 3.5" version of DOS 3.3. After any commands using the 3.5" drive, such as LOAD, SAVE, CATALOG, or whatever, the line number INCREMENT would be cleared to zero. That value is kept by S-C Macro in \$5A, which the 3.5" firmware zeroes. This means after any disk operation you need to type INC 10, or INC with whatever increment you want to use. Luckily, the other three bytes are not actively in use during a disk operation.

In Applesoft these locations hold temporary string descriptors. I think they are only used while executing one statement, so it is possibly all right to share them with the firmware.

Apple probably is not going to do anything about this problem, because supposedly only NEW software would be coming in through the Protocol Converter interface. The ProDOS interface does not have any problem, because it either does not use those locations or it saves-restores them properly.

I think we probably are going to have to be the ones to change. Either we have to add code to our Unidisk DOS 3.3 to save and restore those four bytes, or we have to change the patch to use the ProDOS interface for reading and writing blocks rather than the Protocol Converter. The trouble with the latter approach is that the ProDOS interface requires the use of locations \$42-\$47, and four of these are already in use by higher levels of DOS 3.3! It is hard to win at this game. Either way we end up needing to save and restore four bytes.

Until we decide one way or the other, we need to at least come up with a fix for our Unidisk DOS 3.3 that will allow you to use it with the S-C Macro Assembler without losing your INCrement every time you turn around. Of the four clobbered bytes, only \$5A is critical to the assembler. I found a way to save enough bytes in Bill's code to slip this in. It had to be "slipped" in, so that the references to the DOS patches made in Bill's boot program do not have to be changed.

Lines 1970-2020 in Bill's Unidisk driver were:

```
1970    sta block
1980    ldy #5
1990    lda (iob.ptr),y
2000    lsr
2010    ora block
2020    sta block
```

Replace those lines with the following, which take the same space:

```
1970    asl
1980    ldy #5
1990    ora (iob.ptr),y
2000    ror
2010    sta block
2012    lda $5a
2014    pha
2016    nop
2020    nop
```

This performs the same function as the original code, but adds the feature of saving location \$5A on the stack. At the exit we need to restore \$5A from the stack, so look at lines 3100-3110 of Bill's program. They were:

```
3100    sta (iob.ptr),y
3110    rts
```

Change them to:

```
3100    jmp bobs.patch
```

Then insert new code as follows:

```
3202 bobs.patch
3203    sta (iob.ptr),y
3204    pla
3205    sta $5a
3206    rts
```

I entered the above patches by using the monitor peeking and poking commands, and they do seem to work correctly. Here are the commands I used:

```
00/BF8E:91 48 68 85 5A 60
00/BF82:4C 8E BF
00/BED6:0A A0 05 11 48 6A 8D 89 BF A5 5A 48 EA EA
```

You could add these commands to the EXEC file which loads the IIgs version of the S-C Macro Assembler.

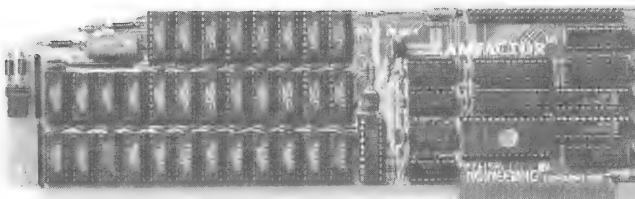
In going over Bill's code while preparing this article, I also noticed that his line 1860, "STA LAST.BLOCK", should be "STA LAST.BLOCK+1". You probably should make this change regardless of what kind of computer you are using.

RamFactor™

Boot any II+, IIe, or IIgs and be up and running your favorite software in less than 1 second.

Now anyone with an Apple II+, Franklin, Laser 128, Apple IIe or IIgs preferring to use slots 1 through 7 can now enjoy the speed and performance that they've been waiting for.

With RamFactor, you'll be able to instantly add another 256K, 512K, or a full 1 MEG on the main board and an expansion connector can address an additional 16 MEG of memory for possible future expansion. Since virtually all software is automatically compatible with RamFactor, you'll immediately be able to load programs into RamFactor for instantaneous access to information. You'll also be able to store more data for larger word processing documents, bigger data bases, and expanded spreadsheets. And with the battery back-up option, you can switch on your Apple and your favorite software will be up and running in less than 1 second!



Very Compatible

All the leading software is already compatible with RamFactor. Programs like AppleWorks, Pinpoint, BPI, Managing Your Money, Dollars and Sense, SuperCalc 3A, PFS, Mouse Write, MouseDesk, MouseCalc, Sensible Speller, Applewriter IIe, Business Works, ReportWorks, Catalyst 3.0 and more. And RamFactor is fully ProDOS, DOS 3.3, Pascal 1.3 and CP/M compatible. In fact, no other slot 1-7 memory card is more compatible with commercial software.

AppleWorks Power

There are other slot 1-7 cards that give AppleWorks a larger desktop, but that's the end of their story. But RamFactor is the only slot 1-7 card that increases AppleWorks internal memory limits, increasing the maximum number of records in the database and lines permitted in the word processor, and RamFactor is the only standard slot card that will automatically load all of AppleWorks into RAM dramatically increasing speed and eliminating the time required to access the program disk, it will even display the time and date on the AppleWorks screen with any ProDOS clock. RamFactor will automatically segment large files so they can be saved on 5½", 3½", and hard disks. All this performance is available on the Apple II+,

IIe, Franklin, or Laser 128 when used with an 80 column display. RamFactor, no other standard slot card comes close to enhancing AppleWorks so much.

The "Instant On" Apple.

With the RamCharger battery backup option, RamFactor will retain programs and data during power failures or even

when you turn your computer off. And because RamFactor plugs into slots 1-7, it's the only memory card that can cold boot an Apple without using slow floppy or hard disks. An available "Y" cable allows one RamCharger to power two RamFactors

Powerful Program Switcher

With RamFactor, you can organize memory into multiple work areas and switch between them. Each work area can contain different programs and even different operating systems. Now you can switch from one program to another or even switch from AppleWorks to DOS 3.3 to CP/M to Pascal to ProDOS in under a second. And with our battery back-up option, you can have permanent storage for up to 20 years.

Features:

- 256K to 1 MEG on main board. Expansion connector for possible further expansion to 16 MEG.
- Fully Apple II Memory Expansion compatible
- Compatible with Apple IIe, II+, IIgs, Franklin and Laser 128
- Battery back-up option allows you to turn on your Apple and run your favorite programs in less than 1 second!
- Automatically recognized by ProDOS, DOS 3.3, Pascal, and standard CP/M
- Built-in RamDrive™ software (a true RAM disk not disk caching)
- Systems are directly bootable from RamFactor if desired
- Built-in self diagnostic software
- Automatic expansion with AppleWorks 1.3 or 2.0
- Allows Apple II+ and IIe to run your AppleWorks without buying any additional software
- Accelerates AppleWorks
- Displays time and date on the AppleWorks screen with any ProDOS clock
- Fits any I/O slot except slot 3
- Fully socketed and user upgradeable
- Much, much more



RamFactor with 256K	\$239
RamFactor with 512K	\$279
RamFactor with 1 MEG	\$359
RamFactor with 2-16 MEG	CALL
RamCharger backup option	\$179
"Y" cable	\$24

(Allows one RamCharger to power two RamFactors.)

Order RamFactor today . . . with 15 day money back guarantee and our "no hassle" five year warranty. See your dealer or call (214) 241-6060, 9 a.m. to 11 p.m., 7 days, or send check or money order to Applied Engineering, MasterCard, Visa and C.O.D. welcome. Texas residents add 6 1/4 sales tax. Add \$10.00 if outside U.S.A.

AE Applied Engineering™
The Apple enhancement experts.

(214) 241-6060

P.O. Box 798, Carrollton, TX 75006

IIgs Tool Set Version Numbers.....Bob Sander-Cederlof

According to Apple's published specifications, all IIgs tool sets are supposed to contain a function which returns a version number. Furthermore I think we can expect that the version numbers will be updated whenever any changes are made to the tools. Hopefully, programs which use the tools can first check to see if the version in ROM or RAM is up-to-date enough to be used.

It would be nice to be able to run a little program which would list the current version number for all installed tools. I wrote such a program, and it is shown below.

Since I am running under control of the S-C Macro Assembler Version 2.0, my program will receive control from the emulation mode. Therefore lines 1110-1130 get me into full native mode so that I can call tools. When I am finished, lines 1280-1290 put me back in emulation mode and return to the S-C Macro control.

The body of the program is a loop to call each of the tool sets from 1 to \$20. Function number 4 of each tool is supposed to return the version number. This function requires one two-byte parameter space on the stack, in which to return the version number. Lines 1170-1190 set up the call and call a tool, and lines 1200-1220 store any error code returned as well as the version number. If the tool is not installed we will get an error code of 0002.

To display the results I wrote a little subroutine which runs in emulation mode. This is convenient, since all of our friendly monitor ROM I/O routines left over from the old days are only callable from emulation mode. There are probably some nice tools in the IIgs to take the place of COUT, PRBYTE, CROUT, and others, but these old friends are certainly easier to use and to remember.

My display routine prints an encoded string. Any bytes in the string which have the high bit on are printed as ASCII characters by calling COUT at \$FDED. Any byte in value between \$01 and \$7F is treated as an index into page zero. The contents of the indexed location are printed out in hexadecimal by calling PRBYTE at \$FDDA. A \$00 byte in the string marks the end.

PRINT.FORMAT is called with the Y-register pointing just before the first character to be printed. This arrangement lets me break after printing the version number, and then just call PRINT.FORMAT again to print the error number when there is one.

Note at line 1370 I get the status byte I pushed at line 1320 by using a stack-relative LDA. Then I used LSR to shift bit 0, which was the carry bit, into C. Why didn't I use PLP followed by a PHP here? It would save one byte and have the same net effect, right?

Well I tried that, and it didn't work. The reason is that the

PLP-PHP is inside my emulation mode subroutine. In emulation mode it is impossible to keep the status bits in the m- and x-bit positions in a zero state. Regardless of what they were when I pushed them at line 1320, after a PLP-PHP operation in emulation mode they will both be 1's. This undid the calling program, which believed it was still in full 16-bit mode. Zap! Pow! Wham! Beep! So I used the safer approach.

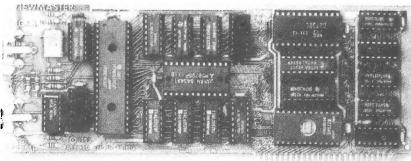
If you want to adapt the display subroutine for other purposes and use it in an older Apple that doesn't have a 65816 in it, you can go back to the PLP-PHP method. You will also need to change the BRA opcodes at lines 1540 and 1560 to JMP's.

```

1000 *SAVE S.TOOL VERSIONS
1010 -----
1020 .OP 65816
1030 -----
01- 1040 TOOL .EQ $01,02
03- 1050 VERSION .EQ $03,04
05- 1060 ERROR .EQ $05,06
1070 -----
1080 * Program to display Version Numbers of All Tools
1090 -----
1100 DVN
000800- 18 1110 CLC
000801- FB 1120 XCE
000802- C2 30 1130 REP #$30 "Full" Native mode
000804- A9 01 04 1140 LDA #$0401 For TOOL = $0401 to $0420
000807- 85 01 1150 STA TOOL
000809- F4 00 00 1160 -----
00080C- A6 01 1170 .1 PEA 0 Make room for version number
00080E- 22 00 00 E1 1180 LDX TOOL Tool # and function
000812- 85 05 1190 JSR $E10000 Go get it!
000814- 68 1200 STA ERROR Any error code
000815- 85 03 1210 PLA Tool version #
000817- 20 25 08 1220 STA VERSION
00081A- E6 01 1230 JSR DISPLAY.RESULTS
00081C- A5 01 1240 INC TOOL Next tool set
00081E- C9 21 04 1250 LDA TOOL ...only go so far...
000821- 90 E6 1260 CMP #$0421
000823- FB 1270 BCC .1 ...not there yet
000824- 60 1280 XCE ...that is far enough
000825- 08 1290 RTS
1300 -----
1310 DISPLAY.RESULTS
000826- 38 1320 PHP
000827- FB 1330 SEC
000828- A0 FF 1340 XCE
00082A- 20 39 08 1350 LDY #-1
00082D- A3 01 1360 JSR PRINT FORMAT
00082F- 4A 1370 LDA 1,S GET STATUS BYTE
000830- 90 03 1380 LSR TO SEE IF THERE WAS AN ERROR
000832- 20 39 08 1390 BCC .1 ...NO ERROR
000835- 18 1400 JSR PRINT FORMAT
000836- FB 1410 .1 CLC
000837- 28 1420 XCE
000838- 60 1430 PLP
000839- C8 1440 RTS
1450 -----
1460 PRINT FORMAT
00083A- B9 4F 08 1470 .1 INY
00083D- 30 0A 1480 LDA FORMAT,Y
00083F- F0 0D 1490 BMI :2
000841- AA 1500 BEQ :3 ...END OF FORMAT
000842- B5 00 1510 TAX
000844- 20 DA FD 1520 LDA 0,X
000847- 80 F0 1530 JSR $FDDA
000849- 20 ED FD 1540 BRA .1
00084C- 80 EB 1550 .2 JSR $FDED
00084E- 60 1560 BRA .1
00084F- 00 00 1570 .3 RTS

```

Now run AppleWorks™ on your II+ and keep full 80 column compatibility!



	BUILT-IN SOFTKEYS	SWITCH REPORTS	LOW POWER BACKUP	80 COLUMN MONITOR	7, 9, 10, 16 KEY	LIGHT PEN INPUT	80 COLUMN COPIER	INVERSE CHARACTERS
VIEWMASTER 80	-	-	-	-	-	-	-	-
SUPERTERM	-	-	-	-	-	-	-	-
WIZARD 80	-	-	-	-	-	-	-	-
VISION 80	-	-	-	-	-	-	-	-
OMNIVISION	-	-	-	-	-	-	-	-
VIEWMAX 80	-	-	-	-	-	-	-	-
SMARTTERM	-	-	-	-	-	-	-	-
VIDEOTERM	-	-	-	-	-	-	-	-

One look at the chart will give you some of the reasons there's only one smart choice in 80 column cards for your Apple. But the real secret to Viewmaster 80's success is something even better: Total compatibility.

Each Viewmaster 80 includes our powerful Apple-Works expand software, allowing AppleWorks to run on the II+ with only 64K (or more) memory. (We recommend the RamFactor memory card, but any compatible Apple memory card will work.) The software provides our full range of AppleWorks enhancements, including expanded records, word processor, multi-disk saving, time and date display on screen with any PRO-DOS clock, and more!

The Viewmaster 80 works with all 80 column applications, including DOS 3.3, PRO-DOS, CPM, Pascal, WordStar, Format II, Applewriter II, dBase II, Visicalc, Multiplan, and *hundreds* of others—including AppleWorks.

Here are just a few of the powerful features the Viewmaster 80 delivers for a great price (\$149):

- 80 Characters by 24 lines • Fully compatible with all Apple languages and software • Highest compatibility with existing 80 column software • Very low power consumption • High speed (18 MHZ) scroll rate • Upper and lower case characters and true descenders, both inverse and normal; all on-screen editing functions are supported • User-definable cursor shape • Compatible with Apple II, II+ and III • Five-year warranty

Call today to order or for more information, 9 a.m. to 11 p.m. seven days, or send check or money order to Applied Engineering, MasterCard, VISA and C.O.D. welcome. Texas residents add 5 1/4% sales tax. Add \$10.00 outside U.S.A.

CP/M is a registered trademark of Digital Research, Inc.

AE Applied Engineering
P.O. Box 798, Carrollton, TX 75006
(214) 241-6060

00084F- 8D	1580	*
000850- D4 EF EF EC	1590	FORMAT .HS 8D
000854- A0	1600	.AS -"Tool"
000855- 01	1610	.DA #TOOL
000856- A0 F6 E5 F2		
00085A- F3 E9 EF EE		
00085E- A0	1620	.AS -" version "
00085F- 04 03	1630	.DA #VERSION+1,#VERSION
000861- 00	1640	.HS 00
	1650	*
000862- A0 E5 F2 F2	1660	.AS -" error "
000866- EF F2 A0	1670	.DA #ERROR+1,#ERROR
000869- 06 05	1680	.HS 00
00086B- 00	1690	*

We Make Measurement And Control Easy!

12 BIT, 16 CHANNEL PROGRAMMABLE GAIN A/D

- All new 1984 design incorporates the latest in state-of-the-art I.C. technologies.
- Complete 12 bit A/D converter, with an accuracy of 0.02%!
- 16 single ended channels (single ended means that your signals are measured against the Apple's GND) or 8 differential channels. Most all the signals you will measure are single ended.
- 9 software programmable full scale ranges, any of the 16 channels can have any range at any time. Under program control, you can select any of the following ranges: ±10 volts, ±5V, ±2.5V, ±1.0V, ±500MV, ±250MV, ±100MV, ±50MV, ±25MV.
- Very fast conversion (25 micro seconds).
- Analog input resistance greater than 1,000,000 ohms.
- Laser-trimmed scaling resistors.
- Low power consumption through the use of CMOS devices.
- The user connector has +12 and -12 volts on it so you can power your sensors.
- Only elementary programming is required to use the A/D.
- The entire system is on one standard size plug in card that fits neatly inside the Apple.
- System includes sample programs on disk.

PRICE \$319

A few new applications may include the monitoring of ● flow ● temperature ● humidity ● wind speed ● wind direction ● light intensity ● pressure ● RPM ● soil moisture and many more.

A/D & D/A

- Single PC card
- 8 channels A/D
- Superfast conversion time
- Very easy programming
- Many analog ranges
- Manual contains sample applications

A/D SPECIFICATIONS

- 0.3% accuracy
 - On-board memory
 - Fast conversion (.078 MS per channel)
 - A/D process totally transparent to Apple (looks like memory)
 - User programmable input ranges are 0 to 10 volts, 0 to 5, -5 to +5, -2.5 to +2.5, -5 to 0, -10 to 0.
- The A/D process takes place on a continuous, non-blocking basis. Data is automatically transferred to its proper location in the on-board RAM. No A/D converter could be easier to use.

D/A SPECIFICATIONS

- 0.1% accuracy
- On-board memory
- On-board output buffer amps can drive 5 MA
- D/A process is totally transparent to Apple (just passes data)
- Fast conversion (.003 MS per channel)
- User programmable output ranges are 0 to 5 volts and 0 to 10 volts

The D/A section contains 8 digital to analog converters, with output buffer amplifiers and all interface logic on a single card. On-card latches are provided for each of the eight D/A converters. No D/A converter could be easier to use. The on-board amplifiers are laser-trimmed during manufacture, thereby eliminating any requirement for off-set nulling.

PRICE \$199

SIGNAL CONDITIONER

Our 8 channel signal conditioner is designed for use with both our A/D converters. This board incorporates a FET op-amp which allows any gain or offset. For example, an input signal that varies from 2.00 to 2.15 volts or a signal that varies from 0 to 50 mV can easily be converted to 0-10V output for the A/D.

The signal conditioner's outputs are on a high quality 16 pin gold I.C. socket that matches the one on the A/D's so a simple ribbon cable connects the two. The signal conditioner can be powered by your Apple or from an external supply.

FEATURES

- 4.5" square for standard card cage and 4 mounting holes for standard mounting. The signal conditioner does not plug into the Apple, it can be located up to ½ mile away from the A/D.
- 22 pin 156 spacing edge card input connector (extra connectors are easily available i.e. Radio Shack).
- Large bread board area.
- Full detailed schematic included.

PRICE \$79

I/O 32

- Provides 4, 8-Bit programmable I/O Ports
- Any of the 4 ports can be programmed as an input or an output port
- All I/O lines are TTL (0-5 volt) compatible

The I/O manual includes many programs for inputs and outputs.

Some applications include:

Burglar alarm, direction sensing, use with relays to turn on lights, sound buzzers, start motors, control tape recorders and printers, use with digital joystick.

PRICE \$89

Please see our other full page ad in this magazine for information on Applied Engineering's Timemaster Click Card and other products for the Apple. Our boards are far superior to most of the consumer electronics made today. All I.C.'s are in high quality sockets with mil-spec. components used throughout. P.C. boards are glass-epoxy with gold contacts. Made in America to be the best in the world. All products are compatible with Apple II and IIe.

Applied Engineering's products are fully tested with complete documentation and available for immediate delivery. All products are guaranteed with a no hassle three year warranty.

Texas Residents Add 5% Sales Tax
Add \$10.00 If Outside U.S.A.

Send Check or Money Order To:

APPLIED ENGINEERING
P.O. Box 798
Carrollton, TX 75006

Call (214) 241-4060

9 a.m. to 11 p.m. 7 days a week
Master, and, Visa & C.O.D. Welcome
No extra charge for credit cards

Apple Assembly Line (ISSN 0889-4302) is published monthly by S-C SOFTWARE CORPORATION, P.O. Box 280300, Dallas, Texas 75228. Phone (214) 324-2050. Subscription rate is \$18 per year in the USA, sent Bulk Mail; add \$3 for First Class postage in USA, Canada, and Mexico; add \$14 postage for other countries. Back issues are \$1.80 each (other countries inquire for postage). A subscription to the newsletter and the Monthly Disk containing all source code is \$64 per year in the US, Canada and Mexico, and \$87 to other countries.

All material herein is copyrighted by S-C SOFTWARE CORPORATION, all rights reserved. (Apple is a registered trademark of Apple Computer, Inc.)